Endangered Species Act - Section 7
Consultation

Biological and Conference Opinion

Approval of Oregon Water Quality Standards for Dissolved Oxygen, Temperature, and pH

Action Agency: U.S. Environmental Protection Agency

Consultation Conducted By: National Marine Fisheries Service, Northwest Region

Date Issued: July 7, 1999

Refer to: OSB99-0146

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I. Background

A. Consultation History

The Oregon Department of Environmental Quality (ODEQ) conducted a triennial review of several of their water quality standards (standards) from 1994 to 1996, concluding in January 1996. The ODEQ conducted a thorough review and deliberation of the scientific literature using a technical committee made up of members drawn from scientific and regulatory agencies, academia, and the regulated community. The technical committee made recommendations to a policy committee, which developed the actual standards using alternatives presented by the technical committee. The ODEQ submitted their revised standards to the U.S. Environmental Protection Agency, Region 10 (EPA) in July 1996. Among the standards reviewed, the groundwater nitrate standard is not included within this consultation as EPA has no approval authority for groundwater standards under the Clean Water Act (CWA). EPA determined in their BA that there will be no effect on endangered species from the approval of the bacteria standard. Therefore, the groundwater and bacteria standards are not addressed in this consultation.

The ODEQ submitted revised water quality standards for dissolved oxygen, temperature and pH to EPA for review and approval on July 11, 1996. In a June 22, 1998, letter from Michael T. Llewelyn, Administrator, Water Quality Division, ODEQ, to Philip Millam, Director, Office of Water, EPA (ODEQ policy letter; Appendix C of BA and Attachment 1 of this Opinion), ODEQ clarified how some of the provisions of their new standards would be implemented.

Because of the significance of Oregon's water quality standards and their potential for affecting threatened and endangered species, in particular salmonids, EPA, the National Marine Fisheries Services (NMFS), and the U.S. Fish and Wildlife Service (FWS) (jointly referred to as the Services) determined that consultation under section 7 of the Endangered Species Act (ESA) should be completed prior to EPA's approval of the standards. EPA commenced the consultation process and review of the standards in January 1997. EPA submitted a request to the Services for a species list on January 15,1997. On February 10, 1997, EPA received from NMFS a species list for Oregon. These lists were updated in 1998 as this analysis was completed. On March 25, 1997, EPA staff conducted a conference call with NMFS and FWS staff to scope the species and issues of concern for this consultation. Decisions were made regarding listed species most likely to be affected by the changes in DO, temperature and pH levels in surface waters. EPA was in frequent contact with the Services on the content and structure of its biological assessment (BA) during its preparation.

The following is a chronology of key steps in this consultation:

- Oregon initiates triennial review -- request for comments from EPA — 5 /22/92 - 6/24/92
- Letters from Oregon to Services requesting early involvement in process — 10/19/92
- Letter from ODEQ to Services requesting input on whether extension of pH criteria to 9.0 would be fully protective of uses for life stages of salmonids and anadromous fish — 11/1/93
- Public comment period on draft standards -- Hearings held 9/5/95 - 9/12/95 Public comment period extended to 1/9/96 — 7/28/95 - 9/19/95
- Oregon adopts water quality standards (effective date March 1,1996 for DO, pH July 1,1996 for temp.) — 1/11/96
- Oregon submits revised water quality standards to EPA — 7/11/96
- EPA requests list of ESA-listed species from Services — 1/15/97
- NMFS provides species list — 2/10/97; updated 6/22/98
- Services' Regional Directors, Director of ODEQ, and EPA RA meet to discuss consultation process and schedule — 5/10/98
- EPA letter to ODEQ Director confirming consultation schedule and inviting state participation — 6/16/98
- ODEQ policy letter to EPA on standards implementation — 6/22/98
- EPA submits final BA to Services — 9/15/98
- EPA, NMFS, and USFWS staff and attorneys meet to discuss consultation issues — 11/18/98
- EPA Regional Administrator, NMFS Regional Director, and staff meet to discuss possible changes to EPA proposed action, draft ODEQ conservation measures, and possible conclusions to the consultation. — 3/24/99

C	EPA, NMFS, USFWS, and ODEQ staff meet to review comments on draft ODEQ conservation measures	5/19/99
C	EPA, NMFS, USFWS, and ODEQ staff meet to review comments on Regional Temperature Criteria Development Project	5/25/99
C	ODEQ submits letter to EPA committing to conservation measures	6/11/99
C	EPA submits letter to Services modifying action to include conservation measures	6/17/99
C	EPA submits BA amendment to NMFS requesting consultation on southwestern Washington/Columbia River coastal cutthroat trout	6/23/99

Section 7(a)(2) of the ESA requires each Federal agency in consultation with NMFS, to ensure that any action it authorizes, funds, or carries out, is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. Conferencing is required for proposed species when the action agency determines that its action is likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. There is no requirement to confer on candidate species. However, because candidate species may be listed before the next triennial review is completed, and because EPA shares a concern with NMFS that it is critical to conserve these species, and to avoid the need for a listing if possible, EPA requested that the consultation cover selected species from the candidate list for the DO oxygen and pH standards. EPA did not request consultation on the temperature standard for candidate species. Proposed, listed and candidate species addressed in this consultation are shown below in Table 1.

Table 1. Proposed, listed and candidate species addressed in this biological and conference opinion.

SPECIES	SCIENTIFIC NAME
Candidate Species	
Coho Salmon Southwestern Washington/Salmon Life River	*Oncorhynchus kisutch*
Steelhead Oregon Coast Klamath Mountains Province	*O. mykiss*
Proposed Species	
Chinook Salmon Southern Oregon/Northern California Coastal (threatened)	*O. tshawytscha*
Coastal Cutthroat Trout Southwestern Washington/Columbia River	*O. clarki clarki*
Listed Species	
Chinook Salmon Snake River Fall (threatened) Snake River Spring/Summer (threatened) Upper Columbia River Spring Run (endangered) Upper Willamette River (threatened) Lower Columbia River (threatened)	*O. tshawytscha*
Chum Salmon Columbia River (threatened)	*O. keta*
Coho Salmon Oregon Coast (threatened) Southern Oregon/Northern California Coasts (threatened)	*O. kisutch*
Sockeye Salmon Snake River (endangered)	*O. nerka*
Sea-Run Cutthroat Trout Umpqua River (endangered)	*O. clarki clarki*
Steelhead Upper Columbia River (endangered) Snake River Basin Steelhead - (threatened) Middle Columbia River (threatened) Upper Willamette River (threatened) Lower Columbia River (threatened)	*O. mykiss*

The objective of this Opinion is to determine whether EPA's proposed approval of Oregon's water quality standards for DO, temperature and pH is likely to jeopardize the continued existence of the proposed and listed species or result in the destruction or adverse modification of designated or proposed critical habitat. This Opinion does not address destruction or adverse modification of critical habitat in those ESUs in which critical habitat has not been designated or proposed. Should any of the proposed species be listed under the ESA, or should critical habitat be designated, the NMFS expects this conference opinion to serve as the basis for a biological opinion on implementation of the action, pursuant to 50 CFR § 402.10(d). Formal consultation and conference will be concluded with the issuance of this Opinion.

B. Overview of Water Quality Standards

The information in this section was taken from the BA. A water quality standard defines the water quality goals of a waterbody by designating the use or uses to be made of the water, by setting criteria necessary to protect the uses and by preventing or limiting degradation of water quality through antidegradation provisions. The CWA provides the statutory basis for the water quality standards program and defines broad water quality goals. For example, Section 101(a) states, in part, that wherever attainable, waters achieve a level of quality that provides for the protection and propagation of fish, shellfish, and wildlife, and recreation in and on the water ("fishable/swimmable").

Section 303(c) of the CWA requires that all states adopt water quality standards and that EPA review and approve these standards. In addition to adopting water quality standards, states are required to review and revise standards every three years. This public process, commonly referred to as the Triennial Review, allows for new technical and scientific data to be incorporated into the standards. The regulatory requirements governing water quality standards are established at 40 CFR 131.

The minimum requirements that must be included in the state standards are designated uses, criteria to protect the uses, and an antidegradation policy to protect existing uses, high quality waters, and waters designated as Outstanding National Resource Waters. In addition to these elements, the regulations allow for states to adopt discretionary policies such as allowances for mixing zones and water quality standards variances. These policies are also subject to EPA review and approval.

Section 303(c)(2)(B) of the CWA requires the state to adopt numeric criteria for all toxic pollutants for which criteria have been published under Section 304(a). EPA publishes criteria documents as guidance to states. States consider these criteria documents, along with the most recent scientific information, when adopting regulatory standards.

All standards officially adopted by the state are submitted to EPA for review and approval or disapproval. EPA reviews the standards to determine whether the analyses performed are adequate

and evaluates whether the designated uses are appropriate and the criteria are protective of those uses. EPA makes a determination whether the standards meet the requirements of the CWA and EPA's water quality standards regulations. EPA then formally notifies the state of these results. If EPA determines that any such revised or new water quality standard is not consistent with the applicable requirements of the CWA, EPA is required to specify the disapproved portions and the changes needed to meet the requirements. The state is then required to make appropriate changes within 90 days. If the state does not adopt the required changes, EPA must promptly promulgate federal regulations to replace those disapproved portions, in accordance with Section 303(c) of the CWA.

Water quality standards are important for several environmental, programmatic and legal reasons. Control of pollutants in surface waters is necessary to achieve the CWA's goals and objectives, including the protection of all species dependent upon the aquatic environment. Water quality standards provide the framework necessary to identify, protect and restore the water quality in Oregon's surface waters.

Water quality standards are important to state and EPA efforts to address water quality problems. Clearly articulated water quality goals established by the water quality standards enhance the effectiveness of many of the state, local and federal water quality programs including point source permit programs, nonpoint source control programs, development of total maximum daily load limitations (TMDLs), and ecological protection efforts.

C. Overview of Oregon's Water Quality Program

In Oregon, ODEQ has responsibility for protecting the quality of the state's waters. The mission of ODEQ is to protect and enhance the quality of Oregon's rivers, streams, lakes, estuaries, and groundwaters and to maintain the beneficial uses for each drainage basin. Anadromous fish passage, salmonid fish rearing, and salmonid fish spawning are included on the list of beneficial uses that Oregon has designated. ODEQ's primary method for achieving this mission is through development, adoption, and application of the state's water quality standards and criteria.

Both federal and state regulations are used to protect Oregon's water quality. State programs are based on the Oregon Revised Statutes and Oregon Administrative Rules (OAR). ODEQ carries out these rules and regulations under the guidance of the Environmental Quality Commission (EQC). Under the federal Clean Water Act the state develops and/or implements:

- Standards to protect beneficial uses of the state's waters.
- A listing of impaired waterbodies (303(d) list) and total maximum daily loads (TMDLs) to restore those impaired waterbodies.
- A Clean Lakes Program.
- Permits, monitoring, and loans for wastewater discharge facilities.
- Programs to control nonpoint sources of pollution.

- Water quality certification of federal activities that could threaten beneficial uses of the state's waters.

Since 1984, the emphasis of Oregon's program has gradually shifted from technology-based controls, i.e., predetermined wastewater quality achievable through application of treatment technology, to water quality-based controls, wherein individual point and nonpoint source discharges are managed based on how they affect the receiving waters. This shift in emphasis is supported by making specific evaluations and assessments of water quality and designating those waters not meeting standards or protecting beneficial uses.

ODEQ has established a statewide ambient river monitoring network of 142 sites which are sampled to provide conventional pollutant data for trend analysis, standard compliance, and problem identification. Sites were selected to represent all major rivers in the state and provide statewide geographical representation (ODEQ 1998). The locations of these sites are intended to reflect the integrated water quality impacts from point and nonpoint source activities as well as the natural geological, hydrological and biological impacts on water quality for the watershed that they represent. In addition, biological and habitat monitoring are conducted to determine the degree to which habitat and biological impairments occur. Water quality conditions are also assessed in association with the issuance of wastewater discharge permits, watershed assessments conducted for TMDLs or site/watershed specific actions, special monitoring initiatives and complaint investigations.

The ODEQ uses data acquired during chemical, physical and biological monitoring studies to evaluate the quality of the state's waters and to design appropriate water quality controls. Waters identified as "water quality limited" are included on the 303(d) list and reported in the 305(b) report, both submitted to EPA biennially.

For each "water quality limited" water on the 303(d) list, ODEQ is required to develop a TMDL. That is, ODEQ determines the total amount of a pollutant (load) that the receiving waters can assimilate while maintaining water quality standards and allocates these loads to the various sources. The CWA requires that all contributing sources, both point and nonpoint, be identified and addressed in this assessment, that seasonal variations be taken into account, that a margin of safety be established to account for uncertainties, and that the attainment of the TMDL lead to the attainment of applicable water quality standards.

Water quality controls for point sources are contained within permits issued based on both federal regulations and state rules. In accordance with the CWA, EPA has delegated authority to ODEQ to issue National Pollutant Discharge Elimination System (NPDES) Permits. NPDES permits are issued to sources discharging to surface waters. State Water Pollution Control Facilities (WPCF) permits are issued to those not discharging to surface waters, e.g., treatment lagoons with land irrigation, or subsurface disposal. If a TMDL has been established for a waterbody, the wasteload allocations established in the TMDL are incorporated into discharge permits. Additionally, effluent limitations in

permits for all waters are required to be written such that discharges do not result in a violation of water quality standards in the receiving water.

Control of nonpoint sources of pollution can occur through several mechanisms. ODEQ has recently developed memoranda of agreement (MOAs) with the Oregon Department of Agriculture (ODA) and the Oregon Department of Forestry (ODF) to address the implementation of TMDLs on state and private forest and agricultural lands in Oregon. In the ODA/ODEQ MOA, the two agencies state their intent to address all parameters exceeding water quality standards and all sources in a geographic area, and to attain water quality standards. ODA, in consultation with ODEQ and local advisory committees, will develop agricultural water quality management plans to address agricultural sources of pollution to water quality limited waters. ODF and ODEQ will work together to ensure that current forest practice rules will either lead to the attainment of water quality standards or be revised to do so. Under the ODF/ODEQ MOA, the best management practices of the Oregon Forest Practice Rules will constitute the mechanism to achieve compliance with water quality standards for forested lands (i.e. no further measures will be taken in the water quality management plan). Where ODF and ODEQ cannot agree that the BMPs are adequate, ODF will monitor the basin to document adequacy of the BMPs. If the monitoring indicates changes are needed in the BMPs, the ODEQ and the Board of Forestry will use OAR 629-635-120 to create watershed-specific protection rules or use other existing authority to ensure that forest management activities do not impair water quality. The same will be done in any basins where ODF and ODEQ agree that the BMPs are not adequate.

NMFS previously expressed concerns about the adequacy of the ODA's Senate Bill 1010 planning program (NMFS 1997) and the Oregon Forest Practice Rules for protection of habitat and water quality (NMFS 1996, 1997, 1998). NMFS remains concerned that proposed rules to carry out subbasin water quality management plans under the SB 1010 program lack measurable objectives for salmon habitat, articulation of practices to achieve objectives, and monitoring commitments sufficient to attain water quality standards and protect anadromous salmonids (May 28, 1999, letter from Rick Applegate, NMFS, to Phil Ward, ODA). With regard to forest practices, riparian buffers for small and medium-sized streams, control of activities that may cause landslides, and cumulative effects were major concerns of NMFS that can affect water quality variables under consideration in this consultation, particularly temperature and intergravel DO. In their findings for their conditional approval of the Oregon Coastal Nonpoint Program, the EPA and the National Oceanic and Atmospheric Administration (NOAA) stated the need for improvements in agricultural and forestry management measures in order to attain water quality standards and protect beneficial uses in coastal water bodies (January 13, 1998, letter and attached findings from Chuck Clarke, EPA, and Jeffrey R. Benoit, NOAA, to Richard P. Benner, Oregon Department of Land Conservation and Development, and Langdon Marsh, ODEQ).

ODEQ is working with federal agencies to develop and implement water quality management plans on federal lands in the state. Additional efforts under the Oregon Plan for Salmon and Watersheds, Coastal Zone Management Plan, National Estuary Program and numerous other federal and state programs are being used to reduce inputs from nonpoint source pollution to Oregon waters.

EPA provides funding and assistance for implementing nonpoint source controls through the Nonpoint Source (Section 319), National Estuary and Coastal Zone Management programs. Assistance in water quality management plan development, funding and implementation is also available through programs of numerous state and federal natural resource agencies including the Natural Resource Conservation Service (NRCS), the Soil and Water Conservation Districts, Oregon Department of Fish and Wildlife (ODF&W) and ODEQ. EPA expects significant funding to become available for nonpoint source controls in the near future through the Clean Water Action Plan (CWAP) and several NRCS Programs including the Riparian Enhancement Initiative under the Conservation Reserve Enhancement Program.

There is an acknowledgment in ODEQ (1995 {b}) that ODEQ was not implementing or enforcing the existing (pre-1996) temperature standards (p 1-5). ODEQ has submitted to EPA a schedule for developing TMDLs based on the 1998 303(d) list by the year 2007 (October 20, 1998 letter from Langdon Marsh, ODEQ, to Chuck Clarke, EPA). The document describes a prioritization process that ODEQ used to develop the schedule. The process assigns four levels of priority, with the highest priority given to subbasins with spawning and rearing habitat of Federally-listed threatened and endangered fish species, or species addressed under the Oregon Plan for Salmon and Watersheds, and the second highest priority given to subbasins with candidate or proposed species for Federal ESA listing, or species listed as critical on the Oregon sensitive species list. Approximately 80% of the 303(d) subbasins fall into these first two priorities, which the schedule indicates will make following the priorities difficult.

For the purposes of this analysis, NMFS assumes that Oregon will develop the needed TMDLs as described above, and that water quality controls will be implemented for point and non-point sources as needed to meet the standards. NMFS therefore will analyze what the effects would be if the water quality standards were achieved in waters inhabited by the anadromous species of concern.

II. Proposed Action

EPA is proposing to approve the DO, temperature, and pH standards as submitted with the exception of the temperature criterion for the Willamette River, mouth to river mile 50. For purposes of this consultation, EPA's action is the proposed approval of Oregon's current water quality standards for DO, temperature, and pH, along with the adoption of certain conservation measures (some of which will be undertaken jointly with the state of Oregon), that are designed to reduce adverse effects associated with some of the water quality standards as quickly as possible. These measures are summarized later in this section and are described in detail in Attachments 2, 3 and 4 of this Opinion.

EPA's action would not change existing water quality standards, as ODEQ already is implementing the standards now under review. EPA is deferring consultation on the temperature criteria for the Willamette River, mouth to river mile 50, until a final action (approval of revised state criterion or EPA promulgation of new criterion) is proposed. Also, EPA did not include the Columbia River temperature standard as part of its approval action, because the standard was not changed.

EPA modified its proposed action to include the following conservation measures (March 24, 1999, meeting between Chuck Clarke, Regional Administrator, EPA and Will Stelle, Regional Director, NMFS, and June 17, 1999, letter from Randall F. Smith, EPA, to Rick Applegate, NMFS {Attachment 2 of this Opinion}). First, EPA will establish and lead a Regional Temperature Criteria Development Project. In this project, technical and policy workgroups with Federal, state, and tribal representatives will develop and recommend to EPA, within two years, a more ecologically relevant temperature criteria protective of all salmonid life history stages. The goals of this project are (1) to develop EPA regional temperature criteria that meet the biological requirements of listed salmonid species for survival and recovery pursuant to ESA and the Clean Water Act (CWA), and can be reasonably implemented; and (2) expected criteria adoption by EPA Region 10 Pacific Northwest states and tribes. Following the completion of the EPA Regional temperature criteria, the state of Oregon will consider revising their temperature standard according to the regional criteria during the 1999-2002 triennial standards review. ODEQ will conduct a concurrent public participation process. However, the state's formal rulemaking process is expected to take an additional 8 to 12 months following completion of the EPA regional criteria. and recommendations. Attachment 4 of this Opinion includes a full description of the Regional Temperature Criteria Development Project.

Second, EPA will provide a grant to the state of Oregon to assist it in carrying out certain conservation measures. These funds are provided under section(s) 104(b)3 of the Clean Water Act. These measures are intended to assure that the standards are being properly applied to protect threatened and endangered salmonids, and that high quality waters are protected and maintained at a high quality. Attachment 3 of this Opinion includes the state's conservation measures and the letter transmitting them to EPA. NMFS understands that should the state fail to meet its commitments regarding the conservation measures, EPA has the authority to reduce federal funding of the state's water quality standards program under the Clean Water Act (for example, grants awarded under Sections 104 and 106).

The action area of this consultation consists of all surface waters of the state of Oregon for which revised DO, temperature and pH criteria have been adopted. The application of these standards are further refined by temporal, spatial, and species-specific provisions to the standards. The standards and provisions are discussed in detail in Section III of the BA. The waterbodies to which each criterion is applicable are identified later in the BA. Water quality standards apply to all surface waters of the state, defined as all lakes, bays, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, marshes, inlets, canals, the Pacific Ocean within the territorial limits of the state of Oregon, and all other bodies of surface waters, natural or artificial, inland or coastal, fresh or salt, public or private (except those private waters which do not combine or effect a junction with natural surface or underground waters), which are wholly or partially within or bordering the state or within its jurisdiction [OAR 340-41-006 (14)]. EPA's approval action does not apply to, and thus the action area does not include, any waters within Indian Country (reservation lands).

III. Listed Species and Critical Habitat

The BA contains summaries of biological information for the listed, proposed and candidate species covered by this Opinion.

The proposed action would occur within designated critical habitat for Snake River sockeye salmon, Snake River spring/summer chinook salmon, Snake River fall chinook salmon, and Umpqua River coastal cutthroat trout.

Essential Snake River salmon habitat consists of four components: (1) spawning and juvenile rearing areas, (2) juvenile migration corridors, (3) areas for growth and development to adulthood and (4) adult migration corridors.

The essential features of the spawning and juvenile rearing areas for Snake River spring/summer chinook salmon and Snake River fall chinook salmon consist of adequate: (1) spawning gravel, (2) water quality, (3) water quantity, (4) water temperature, (5) cover/shelter, (6) food, (7) riparian vegetation, and (8) space.

Essential features of the juvenile migration corridors for Snake River sockeye salmon, Snake River spring/summer chinook salmon, and Snake River fall chinook salmon consist of adequate: (1) substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food, (8) riparian vegetation, (9) space, and (10) safe passage conditions.

The essential features of the Columbia River adult migration corridor for Snake River sockeye salmon, Snake River spring/summer chinook salmon, and Snake River fall chinook salmon include adequate: (1) substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) riparian vegetation, (8) space, and (9) safe passage conditions.

The essential features of the designated in-river areas for Umpqua River coastal cutthroat trout. include adequate substrate, water quality, water quantity, water temperature, food, riparian vegetation, and access. Essential features of the juvenile migration corridors for this species include adequate: (1) substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food, (8) riparian vegetation, (9) space, and (10) safe passage conditions.

The essential features of the designated critical habitat for southern Oregon/northern California Coho Salmon include adequate (1) substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food, (8) riparian vegetation, (9) space, and (10) safe passage conditions.

References for additional background on listing status, biological information, and critical habitat elements for the listed and proposed anadromous salmonids occurring in Oregon are given in Table 2. Additional information, including species distribution maps, scientific reports, and Federal Register notices, is available at NMFS' Internet site: http://www.nwr.noaa.gov/1salmon/salmesa/index.htm

Table 2. References for additional background on listing status, biological information, and critical habitat elements for the listed and proposed anadromous salmonids on the West Coast (noted chronologically by Federal Register publication dates).

Species	Listing Status		Critical habitat (Final Rule)	Biological Information, Historical Population Trends
	Proposed Rule	Final Rule		
Snake River Sockeye Salmon		November 20, 1991; 56 FR 58619	December 28, 1993; 58 FR 68543	Waples *et al*. 1991a; Burgner 1991
Snake River Fall Chinook Salmon		April 22, 1992; 57 FR 34653	December 28, 1993; 58 FR 68543	Waples *et al*. 1991b; Healey 1991
Snake River Spring/Summer Chinook Salmon		April 22, 1992; 57 FR 34653	December 28, 1993; 58 FR 68543	Matthews and Waples 1991; Healey 1991
Upper Willamette River Chinook Salmon		March 24, 1999; 64 FR 14308	N/A	Myers *et al*.1998; Healey 1991
Upper Columbia River Spring Chinook Salmon		March 24, 1999; 64 FR 14308	N/A	Myers *et al*.1998; Healey 1991
Southern OR and CA Coastal Chinook Salmon	March 9, 1998; 63 FR 11482		N/A	Myers *et al*.1998; Healey 1991
Snake River Basin Steelhead		August 18, 1997; 62 FR 43937	N/A	Busby *et al*. 1995; Busby *et al*. 1996
Upper Columbia River Steelhead		August 18, 1997; 62 FR 43937	N/A	Busby *et al*. 1995; Busby *et al*. 1996
Middle Columbia River Steelhead		March 25, 1999; 64 FR 14517	N/A	Busby *et al*. 1995; Busby *et al*. 1996
Upper Willamette River Steelhead		March 25, 1999; 64 FR 14517	N/A	Busby *et al*. 1995; Busby *et al*. 1996
Lower Columbia River Steelhead		March 19, 1998; 63 FR 13347	N/A	Busby *et al*. 1995; Busby *et al*. 1996
Oregon Coast Coho Salmon		August 10, 1998; 63 FR 4258	N/A	Weitkamp *et al*. 1995; Sandercock 1991
Southern OR/Northern CA Coho Salmon		May 6, 1997; 62 FR 24588	May 5, 1999; 64 FR 24049	Weitkamp *et al*. 1995; Sandercock 1991
Columbia River Chum Salmon		March 25, 1999; 64 FR 14308	March 10, 1998; 63 FR 11774	Johnson *et al*.1997; Salo 1991
Umpqua River Cutthroat Trout		August 9, 1996; 61 FR 41514	January 9, 1998; 63 FR 1338	Johnson *et al*.1994, 1999; Trotter 1989
S.W. Washington/ Columbia River Coastal Cutthroat Trout	April 5, 1999; 64 FR 16397		N/A	Johnson *et al*.1999; Trotter 1989

IV. Evaluating Proposed Actions

The standards for determining jeopardy are set forth in Section 7(a)(2) of the ESA as defined by 50 C.F.R. Part 402 (the consultation regulations). The NMFS must determine whether the action is likely to jeopardize the listed species and/or whether the action is likely to destroy or adversely modify critical habitat. This analysis involves the initial steps of (1) defining the biological requirements of the listed species, and (2) evaluating the relevance of the environmental baseline to the species' current status.

Subsequently, NMFS evaluates whether the action is likely to jeopardize the listed species by determining if the species can be expected to survive with an adequate potential for recovery. In making this determination, NMFS must consider the estimated level of mortality attributable to: (1) collective effects of the proposed or continuing action, (2) the environmental baseline, and (3) any cumulative effects. This evaluation must take into account measures for survival and recovery specific to the listed species' life stages that occur beyond the action area. If NMFS finds that the action is likely to jeopardize, NMFS must identify reasonable and prudent alternatives for the action.

Furthermore, NMFS evaluates whether the action, directly or indirectly, is likely to destroy or adversely modify the listed species' critical habitat. The NMFS must determine whether habitat modifications appreciably diminish the value of critical habitat for both survival and recovery of the listed species. The NMFS identifies those effects of the action that impair the function of any essential element of critical habitat. The NMFS then considers whether such impairment appreciably diminishes the habitat's value for the species' survival and recovery. If NMFS concludes that the action will adversely modify critical habitat it must identify any reasonable and prudent measures available.

For the proposed action, NMFS' jeopardy analysis considers direct or indirect mortality of fish attributable to the action. The NMFS's critical habitat analysis considers the extent to which the proposed action impairs the function of essential elements necessary for adult and juvenile migration, adult holding, spawning, rearing and smoltification of the proposed and listed species under the existing environmental baseline.

A. Biological Requirements

The first step in the method NMFS uses for applying the ESA standards of § 7 (a)(2) to listed salmonids is to define the species' biological requirements that are most relevant to each consultation. NMFS also considers the current status of the listed species taking into account population size, trends, distribution and genetic diversity. To assess the current status of the listed species, NMFS starts with the information used to make its determinations to list the particular species for ESA protection (see Table 2 for references), and then considers any new data that is relevant to those determinations. The relevant biological requirements are those necessary for the listed species to survive and recover to naturally reproducing population levels at which protection under the ESA would become unnecessary.

Adequate population levels must safeguard the genetic diversity of the listed stocks, enhance their capacity to adapt to various environmental conditions, and allow them to become self-sustaining in the natural environment.

For this consultation, the NMFS finds that the biological requirements of the proposed and listed species are best expressed in terms of environmental factors that define the water quality attributes necessary for survival and recovery of the species. These factors are described to the extent possible in section V of this Opinion (Analysis of Effects on Listed, Proposed and Candidate Species, and Designated Critical Habitat), while recognizing that a range of results have been reported for some of the factors, and that definitive information does not exist for all species and all life stages. Also, other environmental factors including suitable ocean conditions, fresh-water habitat access, physical habitat elements, channel condition, hydrology, and properly functioning watersheds, where all of the individual factors operate together to provide healthy aquatic ecosystems, are also necessary for the survival and recovery of the proposed and listed species.

B. Environmental Baseline

Populations of anadromous salmonids are at risk or already extinct in many river basins of Oregon, leading to the numerous ESA listings and proposed listings for anadromous fish (Table 2). These populations have declined due to a variety of human activities and natural events including hydropower development, overharvest, land management activities, artificial propagation, water pollution, disease, predation, competition from introduced species, and climatic variation leading to temporarily unfavorable ocean conditions (FEMAT 1993, Henjum et al. 1994, NMFS 1995, National Research Council 1996, Spence et al. 1996, Oregon Coastal Salmon Restoration Initiative 1997, Quigley and Arbelbide 1997).

Land management activities that have degraded habitat of anadromous salmonids include water withdrawals, unscreened water diversions, hydropower development, road construction, timber harvest, stream cleaning of large wood, splash dams, mining, farming, livestock grazing, outdoor recreation, and urbanization (FEMAT 1993, Botkin et al. 1995, National Research Council 1996, Spence et al. 1996, Quigley and Arbelbide 1997). In many Oregon basins, land management activities have: (1) reduced connectivity (i.e., the flow of energy, organisms, and materials) between streams, riparian areas, floodplains, and uplands; (2) elevated fine sediment yields, filling pools and reducing spawning and rearing habitat; (3) reduced instream and riparian large woody debris that traps sediment, stabilizes streambanks, and helps form pools; (4) reduced or eliminated vegetative canopy that minimizes temperature fluctuations; (5) caused streams to become straighter, wider, and shallower, which has the tendency to reduce spawning and rearing habitat and increase temperature fluctuations; (6) altered peak flow volume and timing, leading to channel changes and potentially altering fish migration behavior; (7) altered floodplain function, water tables and base flows, resulting in riparian wetland and stream dewatering; and (8) degraded water quality by adding heat, nutrients and toxicants (FEMAT 1993, USDA Forest Service 1993, Henjum et al. 1994, McIntosh et al. 1994, Rhodes et al.

1994, Wissmar et al. 1994, National Research Council 1996, Spence et al. 1996, Oregon Coastal Salmon Restoration Initiative 1997, Quigley and Arbelbide 1997).

The CWA section 303(d) stream listing information is further evidence of the status of the environmental baseline, although water quality data is available for less than half of Oregon streams. According to the ODEQ, there are approximately 112,000 miles of streams in Oregon mapped by the Water Resources Department. Water quality data of some kind exists for about 35,000 miles of streams (Rick Kepler, ODEQ, pers. comm. with Jeffrey Lockwood, NMFS, October 26, 1998).

Table 3 summarizes the number of waterbodies and streams miles found to be in non-attainment of the DO, temperature and pH standards on Oregon's 1998 303(d) list. For the 1998 list, data for 2,365 streams were reviewed.

Table 3. Summary of 1998 303(d) listed water bodies in Oregon (Source: BA, and ODEQ fact sheets dated October 1998).

Waterbodies on 1998 303(d) List	**Total**	**Dissolved Oxygen**	**Temperature**	**pH**
stream miles	13,687	1,130	12,146	1,117
number of streams	1,067	61	862	49
number of lakes/reservoirs	30	4	0	15

Of the waterbodies reviewed by the state for temperature impairment, 930 waterbody segments are listed for temperature, 542 require additional data or are of potential concern, and 559 segments were meeting the temperature standard. Additional information about the Oregon 303(d) list is available at the ODEQ Internet site: http://waterquality.deq.state.or.us/wq/303dlist/303dpage.htm

A summary of the 1994/96 303(d) list of water quality limited waterbodies provided in the Oregon Coastal Salmon Restoration Initiative showed that only 706 stream miles (11.6%) of those assessed were found to be meeting all state water quality standards (Oregon Coastal Salmon Restoration Initiative 1997).

Based on all the information summarized in this section, not all of the biological requirements of the listed and proposed species for freshwater habitat in general, and for water quality in particular, are being met under the environmental baseline in many streams and watersheds. Their status is such that there must be a significant improvement in the environmental conditions they experience, over those currently available under the environmental baseline, to meet the biological requirements for survival and recovery of these species. Any further degradation of these conditions would significantly reduce the likelihood of survival and recovery of these species due to the amount of risk the salmon face under the

current environmental baseline.

V. Analysis of Effects on Listed, Proposed and Candidate Species, and Designated Critical Habitat

A. Discussion of Effects of Approving Standards

The ESA section 7 implementing regulations define "Effects of the action" as:

> the direct and indirect effects of an action on the species or critical habitat together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur. 50 CFR 402.02.

For the EPA action of approving the Oregon standards, there are no direct effects of consequence to proposed or listed anadromous fish — that is, approving the standards in and of itself will not change the environmental baseline or directly affect listed or proposed species. However, there are significant indirect effects of approving the standards, because the approval allows implementation of the standards to continue. This includes 303(d) evaluations and listings, and development of TMDLs, NPDES permits, and water quality management plans designed to meet the standards over time.

The BA concentrates on the adequacy of the numerical standards under consideration for approval. The analysis of effects in the BA assumes that the species of concern are exposed to waters meeting the water quality standards, and examines what the likely effects on the species would be under that scenario. However, the BA also points out that there are many streams in Oregon that do not meet the standards.

The 1994-96 and the 1998 303(d) lists were based on the standards EPA now proposes to approve. If EPA disapproved any numerical standard now under consideration and the standard was changed by ODEQ or by federal promulgation, the extent of listed waters could change. Making a standard more protective could result in more miles of streams being listed. That could result in more watersheds needing TMDLs and water quality management plans. However, according to ODEQ (June 17, 1999, email from Debra Sturdevant, ODEQ to Jeffrey Lockwood, NMFS), it is unlikely that many additional TMDLs would be required, because temperature TMDLs are being done on watershed or basin scales that encompass both 303(d) listed and non-listed water bodies.

For waters not on the 303(d) list, positive effects of approving the current standards may be concentrated in waters that are later evaluated and found to be in violation of the standard, in which case TMDLs and water quality management plans (WQMPs) may be required. On agricultural lands, Senate Bill 1010 plans would be used for WQMPs; on non-Federal forested lands, Oregon Forest Practice Rules would be used as WQMPs; on Federal lands, Federal lands such as the Bureau of Land Management and the U.S. Forest Service would develop WQMPs; and in urban and rural areas not covered by the above situations, cities and counties would develop WQMPs, working with watershed councils (see also discussion of ODA/ODEQ and ODF/ODEQ MOAs in section IV above). The effectiveness of protection for waters already meeting the standards depends on the antidegradation standard and how it is applied.

The BA also states that as the state completes TMDLs designed to meet the revised standards, issues/reissues permits in conjunction with those TMDLs, and incorporates nonpoint source controls to meet water quality standards, the condition of impaired waters, and thus the environmental baseline, will improve. The effectiveness of the standards for improving the environmental baseline depends on the extent of implementation and the timeframe for implementation. Where permits and nonpoint source controls are implemented, an important effect of the standard is to set the target of restoration efforts. The target may change during implementation, however, due to provisions that allow exceedences of, or exceptions to, the numeric criteria under certain circumstances (see section VIII.C. below for further explanation). According to the BA, these exceedences or exceptions would be treated as site-specific variances or criteria needing EPA review, approval, and consultation under section 7 of ESA.

B. Dissolved Oxygen (DO) Standards

The BA contains information on how the previous standards were revised and on the objectives of the revisions. The Oregon DO water quality standards are included in Appendix B of the BA, and are summarized as they apply to each life history stage discussed below. ODEQ already is implementing the revised standards.

1. Salmonid Spawning and Incubation

The water-column DO standard during salmonid spawning and incubation is 11 mg/l as a 7-day mean minimum. However, if the minimum intergravel DO (IGDO), measured as a spatial median, is 8.0 mg/l or greater, then the water column DO standard is 9.0 mg/l as an absolute minimum. Where conditions of barometric pressure, altitude, and temperature preclude attainment of the 11.0 mg/l or 9.0 mg/l criteria, DO levels shall not be less than 95% saturation.

a. Effects on Snake River Sockeye Salmon, Upper Columbia River spring chinook salmon, and Upper Columbia River steelhead:

Snake River Sockeye Salmon, Upper Columbia River spring chinook salmon, and Upper Columbia River steelhead do not spawn in waters of the State of Oregon, so they are not subject to this standard. Therefore, the DO standard for salmonid spawning and incubation is not likely to adversely affect these species.

> b. Effects on Chinook Salmon (Snake River spring/summer and fall, Upper Willamette River, Lower Columbia River, Southern Oregon/California Coastal), Coho Salmon (Southwest Washington/Lower Columbia River, Oregon Coast, and Southern Oregon/Northern California), Columbia River Chum Salmon, Steelhead Trout (Snake River Basin, Middle and Lower Columbia, Upper Willamette, Oregon Coast, and Klamath Mountains Province), and cutthroat trout (Umpqua River sea-run, and southwestern Washington/Columbia River coastal):

The ODEQ has clarified where and when salmonid spawning is to be protected in a table attached to the June 22, 1998 ODEQ policy letter. The letter states that when there are site-specific differences in these spawning periods the ODEQ will provide protection via implementation of the antidegradation policy (to protect existing uses that weren't designated) and will make adjustments to their standards as necessary to refine the use designations. These adjustments would be water quality standards revisions that would be submitted for EPA review and approval as well as consultation under Section 7 of the ESA.

From spawning until fry emergence from the gravels, the spatial median intergravel DO (IGDO) standard is 6.0 mg/l. A spatial median IGDO of 8.0 mg/l is to be used to identify where the beneficial uses may be impaired and require action by the ODEQ. The ODEQ may, in accordance with established priorities, then evaluate the water quality and initiate pollution control strategies.

Any reduction in DO below saturation increases the risk of adverse sublethal or lethal effects. For many fish species, the embryonic and larval stages often require the highest DO concentrations. For most fish, the time to hatching increases, and growth and survival decrease, as DO decreases. Reductions in DO can decrease swimming performance in both adult and juvenile fish, affecting a the ability to migrate, forage and avoid predators (ODEQ 1995 (a); Spence et al. 1996).

Low DO concentrations increase the acute toxicity of various toxicants such as metals (e.g., zinc) and ammonia (ODEQ 1995(a)). At low intergravel DO (IGDO) and water velocity, ammonia exposure can adversely affect eggs in redds. Adverse effects of toxicants may be compounded by low DO. Also, toxicants may increase sensitivity to low concentrations of DO. For example, any toxicant which damages the gill epithelium can decrease the efficiency of oxygen uptake.

Productive streams exhibit diurnal cycles in water-column DO concentrations due to photosynthesis and respiration. Although fish can detect and will attempt to avoid reduced concentrations of DO, average measurements of DO do not reflect the damage that can occur during diurnal minima. Other

important factors include the length and frequency of fish
exposure to the low DO level. The BA contains additional information and references regarding mechanisms for effects of DO concentrations.

For coho young-of-the-year, any reduction in DO below 9.0 mg/l reduced the maximum swimming speed (Davis et al.1963, as cited in ODEQ 1995(a)). Reductions were approximately 5 percent at 7 mg/l. For chinook salmon, one test indicated reduced swimming speed below 9 mg/l, while a second test indicated that 95 percent of maximum swim speed was attained at 7.0, 7.5, and 6.5 mg/l at temperatures of 10, 15, and 20° F, respectively. Dahlberg et al. (1968, as cited in ODEQ 1995(a)) found that a reduction in DO to 7.5 mg/l resulted in a 5 percent reduction in swimming speed. Dahlberg noted that swimming speed declined markedly below 7-8 mg/l DO. The ecological significance of reduced swimming ability has not been well documented.

In several species studied, fish growth appeared to be determined by the daily minimum of DO, not the average or maximum. Studies reviewed in ODEQ (1995 (a)) indicate possible 5-20% reductions in growth of juvenile coho salmon between 8.0 and 6.5 mg/l DO.

The IGDO standard is relevant to salmonid eggs and larvae. Late emerging and small-sized fry resulting from low IGDO are poor competitors and face almost certain death from predation, disease, starvation, or, most likely, a combination of these. Although any reduction in IGDO from saturation appears to increase the likelihood of adverse effects to embryos and fry of various species of salmonids, important reductions in survival and size at emergence generally are reported to appear below 8 mg/l IGDO, and survival is poor or negligible below 6 mg/l (various studies reviewed in ODEQ (1995(a)), the BA, and Spence et al. (1996).

Under the ODEQ standard, the spatial median IGDO standard is 6.0 mg/l from spawning until fry emergence from the gravels. Although ODEQ may undertake a review where IGDO falls below 8.0 mg/l, there is no assurance in the standard that the ODEQ will take action in these areas. EPA determined that the IGDO criterion of 6 mg/l is likely to adversely affect all of the anadromous fish species on which it requested consultation.

In waters meeting the 6.0 mg/l IGDO standard, anadromous salmonids would suffer reduced survival and size at emergence, particularly in streams with elevated sediment levels. Broad-scale surveys and reviews indicate such impairments generally are widespread in managed watersheds containing the listed, proposed and candidate species (FEMAT 1993, McIntosh et al. 1994, Rhodes et al. 1994, Wissmar et al. 1994, Spence et al. 1996, Oregon Coastal Salmon Restoration Initiative 1997), although data on IGDO is lacking for most stream reaches in Oregon (October 30, 1998 memo from Debra Sturdevant, ODEQ, to Jeffrey Lockwood, NMFS).

ODEQ has committed to using 8.0 mg/l IGDO as a listing criterion for impaired water bodies where there are listed species, beginning with the year 2000 303(d) list (see measure 6 in Attachment 3 of this

Opinion). This standard is likely to meet the biological requirements of the listed species of anadromous salmonids. To the extent that their habitat overlaps with those of the listed species, proposed and candidate species may also benefit from this criterion.

In waters where there is water column DO data but no IGDO data, embryos and fry would be covered by the 11 mg/l water column DO standard. EPA (1986) recommendations for water column DO assume a loss of at least 3 mg/l from surface water to intergravel DO concentrations. According to the BA, substrate with more than 15 percent fine sediment may reduce IGDO to unacceptable levels for survival and incubation (Skaugset 1980, as cited in the BA). Since IGDO is inversely related to the amount of organic fine sediment, the estimated loss of 3 mg/l may underestimate the intergravel DO reduction, relative to the water column, in streams with high sedimentation.

The water-column DO standard during salmonid spawning and incubation (11 mg/l as a 7-day mean minimum, or 9.0 mg/l as an absolute minimum if the minimum IGDO, measured as a spatial median, is 8.0 mg/l or greater), is likely to meet the biological requirements of the listed, proposed, and candidate species of anadromous salmonids, provided the criteria are in effect throughout the periods of spawning and incubation for a given species of anadromous fish. However, IGDO achieved under the water column standard may not meet the biological requirements of embryos and fry of these species in streams with high sedimentation. This underscores the need for increased monitoring of IGDO, especially in streams with high sediment loads.

Identification of spawning and incubation areas in time and space determine the applicability of these criteria and thereby affects their ability to avoid and minimize adverse effects. NMFS has identified several problems with the state's salmonid spawning table attached to the June 22, 1998 ODEQ policy letter. The dates identified by NMFS and the dates in the ODEQ table are shown below in Table 4.

Table 4. ODEQ and NMFS recommended times for salmonid spawning to fry emergence .

River Basin	Affected Species	ODEQ Dates	NMFS Dates	NMFS' Information Source
Rogue	Southern Oregon/ California coastal chinook (proposed)	Oct.1 - May 31	Sept. 1 - May 31	Myers et al. 1998
Umpqua	Umpqua R. searun cutthroat	Sept. 15 - May 31	Sept. 15 - June 30	Johnson et al. 1999
Columbia	S.W. Washington/ Columbia R. Coastal Cutthroat	Oct. 1 - May 31	Oct. 1 - June 30	Johnson et al. 1999
Willamette - Santiam N and S Forks, McKenzie, Molalla, and Mid Fork Mainstem	Upper Willamette R. chinook, steelhead	Sept. 1 - June 30	Sept. 1 - June 30	Busby et al. 1996; Howell et al. 1985; Myers et al. 1998
Willamette River - Clackamas River	Lower Columbia R. chinook, steelhead	Sept. 15 - June 30	Sept. 1 - July 31	Busby et al. 1996; Howell et al. 1985; Myers et al. 1998
Hood River - Hood River Drainage	Lower Columbia R. steelhead	Sept. 15 - June 30	Sept. 15 - Aug. 31	Busby et al. 1996; Howell et al. 1985
Hood River - Miles Creek Drainage	Middle Columbia R. steelhead	Oct. 1 - June 30	Oct. 1 - July 15	Busby et al. 1996; Howell et al.
John Day	Middle Columbia R. steelhead (listed) and chinook (candidate)	Oct. 1 - June 30	Aug. 15 - July 15	Busby et al. 1996; Howell et al. 1985; Myers et al. 1998
Grande Ronde, Imnaha	Snake River Basin spring/ summer chinook, steelhead	Oct. 1 - June 30	Aug .1 - July 15	Busby et al. 1996; Howell et al. 1985; Lichatowich et al. 1993; Myers et al. 1998

A close examination of salmonid life histories based on available literature indicates that spawning and incubation are likely to occur almost year-round in some of the basins. This makes it difficult to apply water quality criteria for spawning and rearing across entire basins, as is the current practice in Oregon. Resolution of this problem likely will require increased geographic specificity for application of water quality criteria during spawning and incubation.

ODEQ's June 22, 1998 policy letter states that it will protect site-specific differences in these spawning periods via implementation of the antidegradation policy (to protect existing uses that weren't designated), and will make adjustments to their standards as necessary to refine the use designations. However, EPA has acknowledged that a lack of implementation guidance impairs the effectiveness of ODEQ's antidegradation policy. Also, adherence to an antidegradation policy, even if it contained specific guidance, would not ensure a protective IGDO target for restoration efforts. ODEQ's policy letter states it will consult with Oregon Department of Fish and Wildlife to determine differences in spawning periods from the spawning table, and will make waterbody-specific adjustments, which would be changes to the standards, as necessary. However, ODEQ did not indicate whether these changes would be submitted to EPA for approval and section 7 consultation.

Although ODEQ has committed to using the 8.0 mg/l IGDO level as a 303(d) listing criterion, there is inadequate assurance that the standard will protect early or late-spawning anadromous fish in the river basins shown in Table 4. Also, there is inadequate assurance that the water column DO standard for spawning and incubation will protect early or late-spawning anadromous fish in the river basins shown in Table 4. Because of this, the IGDO criterion and the water-column DO criterion for spawning and incubation are likely to adversely affect the following species: Snake River spring/summer and fall chinook salmon (both threatened), Southern Oregon/Northern California Coastal chinook salmon (proposed threatened), Upper Willamette River chinook salmon (threatened), Snake River steelhead trout (threatened), Upper Willamette River steelhead trout (threatened), Middle Columbia River steelhead trout (threatened), Lower Columbia River steelhead trout (threatened), Umpqua River sea-run cutthroat trout, and southwestern Washington/Columbia River coastal cutthroat trout.

The ODEQ has committed to conservation measures intended to address the adverse effects associated with its application of the intergravel and water-column spawning standards for DO (see measure 4 in Attachment 3 of this Opinion). During the 1999-2002 Triennial Review, ODEQ will identify the geographic area and time period to which the spawning criteria for DO will apply. ODEQ will work with the Services, Oregon Department of Fish and Wildlife (ODFW), and others with relevant fish life history information to identify the geographic area and time period within which spawning occurs. Within one year of the final Opinion, ODEQ will identify the geographic area and time period to which the spawning criteria will apply in three pilot basins identified by NMFS in this Opinion, provided adequate information is available. Although the final outcomes of these identification processes are unknown, these efforts have the potential to minimize the adverse effects described above for the water column DO and IGDO standards for spawning and incubation. The ODEQ and EPA have agreed to meet twice a year with the Services to review progress in developing and implementing this measure.

> 2. Cold Water Aquatic Life: DO not less than 8.0 mg/l as an absolute minimum. Where conditions of barometric pressure, altitude, and temperature preclude attainment of the 8.0 mg/l, DO shall not be less than 90 percent of saturation. At the discretion of the ODEQ, when the ODEQ determines that adequate information exists, the DO shall not fall below 8.0 mg/l as a 30-day mean minimum, 6.5 mg/l as a seven-day minimum mean, and shall not fall below 6.0 mg/l as an absolute minimum.

The ODEQ policy letter states that for permitting actions and developing TMDLs, ODEQ would consider the beneficial uses of the water body (including species present, listing status of those species, locations, time periods and presence of sensitive early life stages). . Based on the presence of early life stages or threatened and endangered species the provision for lower DO criteria would not be applied. The ODEQ policy letter did not address proposed or candidate species.

The water-column DO criterion for cold water aquatic life (DO not less than 8.0 mg/l) is likely to meet the biological requirements of, and is not likely to adversely affect, the following listed species: Snake River Sockeye Salmon, Chinook Salmon (Upper Columbia River spring, Snake River spring/summer and fall, Upper Willamette River, Lower Columbia River), Coho Salmon (Southwest Washington/Lower Columbia River, Oregon Coast, and Southern Oregon/Northern California), Columbia River Chum Salmon, Steelhead Trout (Snake River Basin, Upper, Middle and Lower Columbia, Upper Willamette, Oregon Coast, and Klamath Mountains Province), and cutthroat trout (Umpqua River sea-run, and southwestern Washington/Columbia River).

However, the provision in the standard for a cold-water DO of 6.5 mg/l as a seven-day minimum mean, or 6.0 mg/l as an absolute minimum, is likely to adversely affect the following proposed and candidate species for adult and juvenile migration, and juvenile rearing: southwest Washington/Lower Columbia River coho salmon, Oregon Coast and Klamath Mountains Province steelhead, southern Oregon/northern California coastal chinook salmon, and southwestern Washington/Columbia River coastal cutthroat trout. The adverse effects of these provisions of the standard would be similar to those described below for the cool water DO standard. Although some non-lethal adverse effects to migrating adults and juveniles are likely in waters meeting this standard, NMFS does not expect significant increases in mortality due to this standard.

> 3. Cool Water Aquatic Life: DO not less than 6.5 mg/l as an absolute minimum. At the discretion of the ODEQ, when the ODEQ determines that adequate information exists, the DO shall not fall below 6.5 mg/l as a 30-day mean minimum, 5.0 mg/l as a seven-day minimum mean, and shall not fall below 4.0 mg/l as an absolute minimum.

The standard is intended to protect cool-water species where cold-water biota may be present during part or all of the year but would not form the dominant community structure.

The June 22, 1998 ODEQ policy letter states that any salmonid spawning would be covered by the salmonid spawning standard. ODEQ has classified waters for this standard on an ecoregion basis (see Appendix G of the BA for an ecoregion map). Columbia River chum salmon (threatened), southwestern Washington/Columbia River coastal cutthroat trout (proposed threatened), Lower Columbia River chinook (threatened), Lower Columbia River steelhead (threatened), Upper Willamette River steelhead and chinook (both threatened), Middle Columbia River steelhead (threatened), Snake River spring/summer and Snake River fall chinook (both threatened), and Snake River steelhead (threatened) occur in areas subject to the cool water standards. For all of these species, part of their range is covered by the cool water standards, and part is covered by the cold water standards.

In waters meeting this standard, laboratory studies indicate DO in the range of 6.5-8.0 mg/l could reduce swimming ability of adult and juvenile salmonids by 5-10 percent, potentially delaying migrations and reducing the ability to forage and avoid predators (ODEQ 1995 (a); Spence et al. 1996). However, the ecological significance of reduced swimming ability has not been well documented.

In several species studied, fish growth appeared to be determined by the daily minimum of DO, not the average or maximum. Studies reviewed in ODEQ (1995 (a)) indicate possible 5-20% reductions in growth of juvenile coho salmon between 8.0 and 6.5 mg/l DO.

Based on the information above, the cool-water DO standard is likely to adversely affect Columbia River chum salmon (threatened), southwestern Washington/Columbia River coastal cutthroat trout (proposed threatened),] Lower Columbia River chinook (threatened), Lower Columbia River steelhead (threatened), Upper Willamette River steelhead and chinook (both threatened), Middle Columbia River steelhead (threatened), Snake River spring/summer and fall chinook (both threatened), and Snake River steelhead (threatened). Some non-lethal take of migrating adults and juveniles is possible in waters meeting this standard. However, NMFS does not expect significant increases in mortality due to this standard.

The ODEQ has committed to a conservation measure intended to address the adverse effects associated with its application of the cool-water standard for DO (see measure 5 in Attachment 3 of this Opinion). The ODEQ has committed that, during the 1999-2002 Triennial Review, it will identify the geographic area to which the cool-water DO standard will apply. The ODEQ will work with the Services, Oregon Department of Fish and Wildlife, and others with relevant fish life history information to identify where application of the cold-water DO standard is necessary to fully protect threatened and endangered species (see measure 5 in Attachment 3 of this Opinion). Although the final outcome of this process is unknown, this effort has the potential to minimize the adverse effects on listed species from the cool-water DO standard. To the extent that their habitat and life histories overlap with those of the listed species, proposed and candidate species may also benefit from this effort. The ODEQ and EPA have agreed to meet twice a year with the Services to review progress in developing and implementing this measure.

C. Water Temperature Standards

The BA contains information on how the previous standards were revised and on the objectives of the revisions. The Oregon temperature water quality standards are included in Appendix B of the BA, and are summarized below. ODEQ already is implementing the revised standards.

1. Numeric Criteria

The numeric criteria amendments replace a single basin or sub-basin-specific numeric temperature criterion with new criteria applicable to specific species and life stages. Tables in Appendix D of the BA show the applicable criteria for each species, by basin, compared with the previous numeric criteria. The numeric criteria provide that "unless specifically allowed under a Department-approved surface water temperature management plan ..., no measurable surface water temperature increase resulting from anthropogenic activities is allowed:

(i) In a basin for which salmonid fish rearing is a designated beneficial use, and in which surface water temperatures exceed 64.0° F (17.8°C);

(ii) In the Columbia River or its associated sloughs and channels from the mouth to river mile 309 when surface water temperatures exceed 68.0°F (20.0°C);

(iii) In the Willamette River or its associated sloughs and channels from the mouth to river mile 50 when surface water temperatures exceed 68.0°F (20.0°C);

(iv) In waters and periods of the year determined by the Department to support native salmonid spawning, egg incubation, and fry emergence from the egg and from the gravels in a basin which exceeds 55.0°F (12.8°C);

(v) In waters determined by the Department to support or to be necessary to maintain the viability of native Oregon bull trout, when surface water temperatures exceed 50.0° F (10.0°C)"

These provisions apply to both existing activities as well as any proposed new or expanded activities. The ODEQ has not identified adult salmonid migration, adult holding, smoltification, or juvenile salmonid emigration as distinct beneficial use designations; it intends that these aspects of salmonid life history be covered under the salmonid rearing designated use. The ODEQ has clarified where and when salmonid spawning is to be protected in a table attached to the policy letter in Appendix C (see also discussion under Dissolved Oxygen standard above). The Columbia River standard was not revised in the last Triennial Review, so it will not be covered in this consultation.

a. Rearing Temperature Standard - 64.0°F (17.8°C):

ODEQ intends that the rearing standard also cover adult migration, holding, and smoltification (i.e. there are no separate standards for these life stages). Therefore NMFS will analyze effects of this standard on these life stages.

The ODEQ measures attainment of the temperature standards using a seven-day moving average of the daily maximum as the measurement unit. Buchanon and Gregory (1997, as cited in the BA) indicate that the highest daily maximum temperature usually is 0.5 to 2.0°C higher than the 7-day average maximum during the summer. This indicates periodic exposure to waters of 18.3-19.8°C, and relatively long exposures above 15.6°C during the warmest part of the summer. Data submitted by ODEQ for one sample stream each in the Grande Ronde and Tillamook River Basins that are less than 1.2°F over the standard indicate several hours per day spent above 17.8°C and up to 6-12 hours per day spent above 15.6°C. On the other hand, ODEQ has pointed out that for mainstem rivers to meet the current temperature standard, upstream tributaries often will need to be cooler than the standard (June 17, 1999, email from Debra Sturdevant, ODEQ, to Jeffrey Lockwood, NMFS).

The ODEQ's Technical Advisory Committee (TAC) reviewed the literature on temperature and salmonids as part of the 1994-96 Triennial Review. The Final Issue Paper for Temperature (ODEQ 1995 (b)) includes their review. The TAC noted risks to salmonid holding, pre-spawning, juvenile rearing, and smoltification at temperatures above 60°F (15.5°C).

Most studies that have evaluated the response of salmonids to temperature are laboratory experiments, and the majority of these experiments used constant, rather than fluctuating temperatures. Although these studies are instrumental to understanding the effects of temperature on salmonids, extrapolating laboratory results obtained mostly using constant temperatures to natural populations, which are subject to fluctuating temperatures, introduces considerable uncertainty. These uncertainties include but are not limited to the following: (1) Most of the laboratory experiments focused only on temperature and did not examine how temperature interacts with other factors such as sediment, predation, disease, competition, and food resources; and (2) there have been few field studies that have examined how temperature affects naturally reproducing salmon populations or how temperature interacts with other stressors. Thus, because of these data limitations it is difficult to predict accurately what the effects of water temperature will be on salmon populations.

The BA summarizes various studies describing adverse physiological and behavioral effects to salmonids not only from persistent high temperatures, but from intermittent exposure to high temperatures, increased diurnal variation in water temperature, and altered cumulative exposure history of the organism. These adverse effects can include increased pre-spawning mortality; reduced growth of alevins or juveniles; reduced competitive success relative to non-salmonids; out-migration from unsuitable areas; increased disease virulence; reduced disease resistance; and delay, prevention or reversal of smoltification. These concerns also appear in a report on temperature and salmonids prepared under contract to the EPA by McCullough (1999). Both of these documents also describe other thermal problems faced by anadromous fish under the current environmental baseline such as: reduced availability of cold-water refugia due to simplification of habitat and other factors; increasing restriction of suitable temperatures to otherwise marginally-suitable headwater reaches; and phase shifts (changes in timing and duration of seasonal cooling and warming trends).

There are at least two studies that demonstrate or suggest population-scale effects of water temperature changes. In the Carnation Creek study (Holtby 1998), higher late winter and spring water temperatures increased juvenile coho growth, leading to higher survival overwinter, but caused an earlier seaward migration of smolts, decreasing survival. Holtby concluded that increased temperatures (which in summer still were cooler than Oregon's rearing standard) (1) can have quantifiable effects on salmonid populations; (2) these effects can influence more than one life stage simultaneously and in opposite directions; (3) the effects of perturbations at one life stage can persist throughout the remainder of the life cycle; and (4) for anadromous species, the effects of habitat perturbations during freshwater rearing can persist into the marine phase. Therefore, sublethal temperatures experienced at any one life stage may have repercussions for individual fitness and ultimately population and species viability.

A study of the Tucannon River in southeastern Washington by Theurer et al. (1995) models how changes in riparian shade and channel morphology have contributed to increased water temperatures, reduced available spawning and rearing space, and diminished production of steelhead and chinook juveniles. The lower reaches of the river have been degraded by riparian vegetation removal, channel straightening, and high sediment inputs. Using a physically-based water temperature model, the authors reconstructed the historic natural average water temperature profile of the Tucannon River in southeastern Washington that existed prior to riparian vegetation removal and channel modifications. Production of juvenile salmonids was estimated by extrapolating from reaches in which juveniles were surveyed to the remainder of the river. Theurer et al. (1995) found that approximately 24 miles of spawning and rearing habitat had been made unusable in the lower Tucannon River due to temperature changes. Average maximum daily temperatures in the lower river during July were 24°C or greater (considerably warmer than the ODEQ rearing temperature standard of 17.8 °C as the seven-day moving average of the daily maximum). They estimated that approximately 60% of the potential fish production was lost relative to what could be produced if water temperatures were restored throughout the lower reaches. The authors state that the change in temperature regime caused by the loss of riparian vegetation alone is sufficient to explain the reduction in salmonid population in the Tucannon River, while noting that increased sediment input also has played a subsidiary role.

(1) Snake River Sockeye Salmon, Upper Columbia River spring chinook salmon, and Upper Columbia River steelhead:

Snake River sockeye salmon, Upper Columbia River chinook salmon, and Upper Columbia River steelhead do not spawn in waters of the State of Oregon. Their migration corridors in Oregon are limited to the Snake (Snake River sockeye only) and Columbia Rivers. The reach of the Snake River subject to Oregon's rearing temperature standard used by Snake River sockeye salmon is relatively short. Approval of the Columbia River rearing temperature standard is not part of the proposed action. Based on this information, NMFS has determined that EPA's proposed approval of the State of Oregon's water temperature standard for salmonid rearing is not likely to adversely affect Snake River Sockeye Salmon, Upper Columbia River spring chinook salmon, or Upper Columbia River steelhead.

(2) Snake River spring/summer, Snake River fall, Upper Willamette River, Lower Columbia River, and Southern Oregon/California Coastal chinook salmon:

Preferred temperatures for adult migration are 3.3°C-13.3°C for spring chinook salmon, 10.6-19.4°C for fall chinook, and 13.9-20°C for summer chinook (Beschta et al. 1987, Bell 1991, Bjornn and Reiser 1991, Spence et al. 1996). Migration blocks can occur at temperatures of 21°C (ODEQ 1995(b), McCullough 1999). The Independent Scientific Group (1996) cites 10°C as the optimum temperature for chinook migration with a range of 8.0°C-13.0°C, stressful conditions at temperatures greater than 15.6°C, and a lethal temperature of 21°C.

As spring chinook salmon spend several months in freshwater prior to spawning (Myers et al. 1998), water temperature during this period is critical to successful reproduction. Snake River fall chinook salmon migrating upstream reach the mouth of the Snake River from mid-August to October (Waples et al. 1991). Because the spawning standard in the Snake River and its Oregon tributaries does not take effect until October 1, a portion of the spawning population of this species would be subject to the rearing standard during its pre-spawning holding period. Information on holding temperature requirements was available only for spring chinook salmon. ODEQ (1995(b)) cites temperatures of 8.0-12.5°C as required for adult spring chinook salmon holding. Increased mortality of adult spring chinook holding in freshwater has been cited to occur above 13.0-15.5°C (ODEQ 1995(b), McCullough 1999), greater than or equal to 17.5°C (Berman 1990), and 18-21°C (Marine 1992). Disease virulence and the risk of adult mortality increase rapidly above 15.5-16.7°C in chinook, sockeye, and coho salmon (ODEQ 1995(b), McCullough 1999).

Reproductively-mature spring chinook salmon held at temperatures between 17.5 and 19°C had more pre-hatch mortalities and developmental abnormalities, as well as smaller eggs and alevins, than adults held at temperatures between 14.0 and 15.5°C (Berman 1990). Studies reviewed by McCullough (1999) also indicate poor survival of eggs from adult chinook held above 14.0°C. Pre-spawning survival and maturation are optimized at 6.0-14.0°C according to Marine (1992). Adult sockeye salmon held at preferred temperatures lost less of their body weight and maintained visible fat reserves while those held at elevated temperatures lost greater quantities of body weight and visible fat reserves were essentially depleted (Bouck et al. 1977). By depleting essential energy reserves, elevated temperatures during migration or holding periods could reduce reproductive success.

According to studies cited in the BA and to ODEQ (1995b), temperature preferences for spring chinook salmon rearing are in the range of 7.3-14.8°C. The temperature zone in which juvenile growth is positive is 4.5-19°C. At the extremes of this temperature range, growth reaches zero (ODEQ 1995b, McCullough 1999). Optimum production occurs at 10-15.6°C and maximum growth occurs at 14.8-15.0°C (ODEQ 1995(b), McCullough 1999). ODEQ (1995(b)) discussed effects of food supply on temperature tolerance, noting: "If food becomes limiting, the positive growth zone can shrink dramatically, (i.e., the maximum temperature at which growth is still positive declines) and the optimum

growth zone will shift to lower temperatures to compensate for elevated respiration/growth ratios." Temperatures greater than 15.5°C significantly increase the likelihood of disease-related mortality (ODEQ 1995(b), McCullough 1999). The Independent Scientific Group (1996) reports an optimum rearing temperature for chinook salmon of 15°C with a range of 12-17°C and stressful conditions beginning at temperatures greater than 18.3°C.

Competitive abilities of salmonids can be affected by temperature. Juvenile steelhead production was the same at lower water temperatures (12-15°C) whether red shiners were present or not. At warmer water temperatures (19-22°C), steelhead production was lower when shiners were present compared to when shiners were absent (Reeves et. al. 1987).

Most fall chinook migrate downstream in spring, and spring chinook migrate downstream in spring and summer (Bell 1991, ODEQ 1995, Spence et al. 1996). Studies and unpublished data reviewed in the BA and McCullough (1999) demonstrate an inhibitory effect of water temperatures over 15-18°C on smoltification of fall chinook salmon. Snake River fall chinook generally migrate downstream soon after emergence, with most juveniles moving through the Lower Snake River from March through June (Chapman et al. 1991, as cited in Waples et al. 1991). This period would be covered by the spawning temperature standard (12.8°C) in the Snake River and its Oregon tributaries containing this species. Spring chinook require temperatures of 3.3-12.2°C for smoltification and outmigration (ODEQ 1995(b)). ODEQ (1995(b)) states "It is recommended for all salmonids that temperature not exceed 54°F (12.2°C) to maintain the migratory response and seawater adaptation in juveniles..." If spring temperatures are too high, salmon smolts will revert to a pre-smolt physiology and remain in fresh water (Spence et al. 1996, McCullough 1999).

In its BA, EPA found that exposing these chinook species to this standard "poses a risk to their viability." The BA also states that "there is reason to believe that mortality from both lethal and sublethal effects (e.g., reproductive failure, prespawning mortality, residualization and delay of smolts, decreased competitive success, disease resistance) will occur." EPA determined under the ESA that this standard was "likely to adversely affect" these species.

Based on the above information, water temperatures allowed under this standard are likely to cause lethal and sublethal adverse effects including: possible increased mortality of adult spring/summer and fall chinook holding in freshwater during the warmest part of the summer; increased pre-hatch mortalities and developmental abnormalities, as well as smaller eggs and alevins, due to sub-optimal incubation temperatures for pre-spawning spring/summer chinook adults; reduced disease resistance, increased disease virulence, and increased disease incidence for adults and juveniles; reduced growth of juveniles; and delay, prevention or reversal of smoltification for all chinook species except Snake River fall chinook. Snake River fall chinook would be subject to all of the above adverse effects except reduced juvenile growth, and interference with smoltification. Also, production of juveniles of all chinook species except Snake River fall chinook may further be reduced due to the possible out-migration of juveniles from areas made less suitable for rearing by water temperatures, and by increased

competition from other species at higher temperatures. Although attainment of the standard would represent a substantial improvement over the current environmental baseline in many watersheds, conditions in waters meeting this standard likely will not meet the biological requirements of listed and proposed species of chinook salmon.

The EPA and ODEQ worked with the Services to develop measures intended to address adverse effects of the water temperature standards on the listed anadromous fish species (see Attachments 2, 3, and 4 of this Opinion). EPA will lead, and ODEQ will participate in, interagency technical and policy workgroups to review temperature issues and develop proposed EPA Region 10 stream temperature criteria over a two-year period. The goals of this project are (1) to develop EPA regional temperature criteria that meet the biological requirements of listed salmonid species for survival and recovery pursuant to ESA and the Clean Water Act (CWA), and can be reasonably implemented; and (2) expected criteria adoption by EPA Region 10 Pacific Northwest states and tribes. The State of Oregon will consider adoption of the criteria as a state water quality standard during the 1999-2002 triennial review. Although ODEQ will conduct a concurrent public participation process, ODEQ anticipates that the formal state rule-making process will take an additional 8 to 12 months following completion of the EPA criteria and recommendations.

Some of the EPA and ODEQ conservation measures are intended to help prevent degradation of waters that meet the rearing temperature standard (proposed for approval) while the rearing temperature standard is reviewed. Within 3 months of the date by which the Services provide species distribution data layers to ODEQ, ODEQ will identify to the Services upcoming NPDES permits that discharge to streams with listed or proposed fish that are below 64°F, and give the Services an opportunity for early comments on the permit renewals (see measure 2 in Attachment 3 of this Opinion).

The ODEQ also will develop a plan for the implementation of the antidegradation policy by December 31, 2000 (see measure 3 in Attachment 3 of this Opinion). The ODEQ will involve NMFS and the EPA in scoping and review of the draft guidance, will provide an informal response to comments. ODEQ anticipates applying the anti-degradation policy to NPDES permits as they are renewed following completion of the guidance.

These conservation measures initiate processes through which EPA and NMFS anticipate development of additional guidance and procedures about how some of the existing water temperature standards are applied, as well as eventual changes to the standards themselves. Although the final outcomes of these measures are not known, their intent is to minimize adverse effects of these standards on anadromous fish. Also, the Temperature Criteria Development Project has an explicit goal of meeting the biological requirements of the listed anadromous fish species. Taken together, these measures have the potential to meet the biological requirements of the listed and proposed anadromous fish species beginning in the years 2000-2005, depending on the measure in question.

(3) Oregon Coast, and Southern Oregon/Northern California coho

salmon:

The temperature preference range for migrating adult coho salmon is 7.2-15.6°C (ODEQ 1995 (b), Bell 1991, Beschta et al. 1987). A general preferred temperature range of 12-14°C with temperatures greater than 15°C generally avoided was reported by Brett (1952). Adult coho final temperature preferences were 11.4°C in a laboratory and 16.6°C in Lake Michigan (Coutant 1977). Disease virulence and the risk of adult mortality increase rapidly above 15.5-16.7°C in chinook, sockeye, and coho salmon (ODEQ 1995(b), McCullough 1999).

In Oregon, coho salmon begin entering rivers between late August and October, depending on the river basin. In most rivers, peak river entry is in October or later (Weitkamp et al. 1995). Early-run coho may hold for extended periods of time before spawning (Sandercock 1991), so adult holding temperatures are likely important to successful reproduction. Similar sublethal effects as described for spring chinook salmon above are possible during adult coho holding in the late summer and early fall. However, the proportion of the population that would be exposed is smaller and the duration of exposure shorter for coho than for spring chinook. Also, the salmonid spawning standard (12.8°C) goes into effect between September 15 and October 1, depending on river basin, and stays in effect until May 31, according to the ODEQ policy letter.

Rearing temperature preferences for coho salmon are cited as 11.8-14.6°C (ODEQ 1995(b), Beschta et al. 1987, Brett 1952), and 11.4°C (Coutant 1977). Cessation of growth occurs at temperatures greater than 20.3°C (ODEQ 1995(b), Beschta et al. 1987, Brett 1952). Temperatures greater than 15.5°C significantly increase the risk of disease-related mortality (ODEQ 1995(b), McCullough 1999).

Competitive abilities of salmonids can be affected by temperature. Juvenile steelhead production was the same at lower water temperatures (12-15°C) whether red shiners were present or not. At warmer water temperatures (19-22°C), steelhead production was lower when shiners were present compared to when shiners were absent (Reeves et. al.1987).

The preferred smoltification temperature range for coho salmon is reported as 12.0-15.5°C (Brett et al. 1958), and less than 12.0°C (Wedmeyer et al.1980, as cited in McCullough (1999). Migration temperatures for coho are 2.5-13.3°C with most fish migrating before temperatures reach 11.0-12°C (Spence et al. 1996). In Oregon, downstream migration occurs from March to July (Bell 1991). Under Smoltification and Smolt Migration, ODEQ (1995(b)) states “It is recommended for all salmonids that temperature not exceed 54° F (12.2°C) to maintain the migratory response and seawater adaptation in juveniles..."

In its BA, EPA found that exposing these species to this standard “poses a risk to their viability.” The BA also states that “there is reason to believe that mortality from both lethal and sublethal effects (e.g., reproductive failure, prespawning mortality, residualization and delay of smolts, decreased competitive success, disease resistance) will occur.” EPA determined under the ESA that this standard was “likely to adversely affect” these species.

Based on the above information, water temperatures allowed under this standard are likely to cause lethal and sublethal adverse effects including: increased pre-hatch mortalities and developmental abnormalities, as well as smaller eggs and alevins, due to sub-optimal incubation temperatures for pre-spawning coho salmon adults (particularly in river basins with early river entry); increased disease risk; reduced growth of juveniles; and delay, prevention or reversal of smoltification in late-migrating juveniles. Also, production of juveniles may further be reduced due to the out-migration of juveniles from areas made unsuitable for rearing by water temperatures, and by increased competition from other species at higher temperatures. Although attainment of the standard would represent a substantial improvement over the current environmental baseline in many watersheds, conditions in waters meeting this standard likely will not meet the biological requirements of coho salmon.

The EPA and ODEQ worked with the Services to develop measures intended to address adverse effects of the water temperature standards on the listed anadromous fish species (see discussion under section V.C.1.a.{2}, chinook salmon {above}, and Attachments 2, 3, and 4 of this Opinion). These conservation measures initiate processes through which EPA and NMFS anticipate development of additional guidance and procedures about how some of the existing water temperature standards are applied, as well as eventual changes to the standards themselves. Although the final outcomes of these measures are not known, their intent is to minimize adverse effects of these standards on anadromous fish. Also, the Temperature Criteria Development Project has an explicit goal of meeting the biological requirements of the listed anadromous fish species. Taken together, these measures have the potential to meet the biological requirements of the listed and proposed anadromous fish species beginning in the years 2000-2005, depending on the measure in question.

(4) Snake River Basin, Middle and Lower Columbia, Upper Willamette, and Oregon Coast steelhead trout:

NMFS did not find migration preference data specific to adult steelhead. However, Beschta et al. (1987) and McCulllough (1999) note that migratory inhibition occurs at 21°C. A general preferred temperature range of 10-13°C was reported by Bjornn and Reiser (1991) and of 7.2-14.4°C by Bell (1991). An optimum range of 10.0-12.8°C was reported by Bell (1991).

As summer steelhead in Oregon enter freshwater from spring to summer and spawn the following year from late winter to spring (Busby et al. 1996), adult holding temperatures are likely critical to successful reproduction. Similar effects as described for spring chinook salmon above are likely.

NMFS did not find temperature preference data specific to juvenile steelhead. As stated above, a general preferred temperature range of 10-13°C was reported by Bjornn and Reiser (1991) and of 7.2-14.4°C by Bell (1991). An optimum range of 10.0-12.8°C was reported by Bell (1991). In laboratory experiments, Wurtsbaugh and Davis (1977, as cited in McCullough 1999) concluded that

temperatures less than 16.5°C were optimum for steelhead growth. Juvenile coho salmon responses to fluctuating temperatures after acclimation to fixed and fluctuating temperatures were reported by Thomas et al. (1986, as cited in McCullough 1999). Temperatures greater than 15.5°C significantly increase the risk of disease-related mortality (ODEQ 1995(b), McCullough 1999).

Competitive abilities of salmonids can be affected by temperature. Juvenile steelhead production was the same at lower water temperatures (12-15°C) whether red shiners were present or not. At warmer water temperatures (19-22°C), steelhead production was lower when shiners were present compared to when shiners were absent (Reeves et. al. 1987).

Columbia River steelhead out-migrate in spring and summer (Bell 1991). NMFS did not find out-migration information for coastal populations. Based on laboratory studies, the upper limit for parr-smolt transformation and out-migration of steelhead trout appears to be 11.3-13.0°C (Zaugg et al. 1972, Adams et al. 1975, Zaugg and Wagner 1973, Zaugg 1981, McCullough 1999). Under Smoltification and Smolt Migration, ODEQ (1995(b)) states "It is recommended for all salmonids that temperature not exceed 54° F (12.2°C) to maintain the migratory response and seawater adaptation in juveniles..."

In its BA, EPA found that exposing these species to this standard "poses a risk to their viability." The BA also states that "there is reason to believe that mortality from both lethal and sublethal effects (e.g., reproductive failure, prespawning mortality, residualization and delay of smolts, decreased competitive success, disease resistance) will occur." EPA determined under the ESA that this standard was "likely to adversely affect" the species.

Based on the above information, water temperatures allowed under this standard are likely to cause lethal and sublethal adverse effects including: increased pre-hatch mortalities and developmental abnormalities, as well as smaller eggs and alevins, due to sub-optimal incubation temperatures for pre-spawning steelhead adults (particularly in river basins with early river entry); increased disease risk; reduced growth of juveniles; and delay, prevention or reversal of smoltification in late-migrating juveniles. Also, production of juveniles may further be reduced due to the out-migration of juveniles from areas made unsuitable for rearing by water temperatures, and by increased competition from other species at higher temperatures. Although attainment of the standard would represent a substantial improvement over the current

environmental baseline in many watersheds, conditions in waters meeting this standard likely will not meet the biological requirements of steelhead trout.

The EPA and ODEQ worked with the Services to develop measures intended to address adverse effects of the water temperature standards on the listed anadromous fish species (see discussion under section V.C.1.a.{2}, chinook salmon {above}, and Attachments 2, 3, and 4 of this Opinion). These conservation measures initiate processes through which EPA and NMFS anticipate development of additional guidance and procedures about how some of the existing water temperature standards are applied, as well as eventual changes to the standards themselves. Although the final outcomes of these measures are not known, their intent is to minimize adverse effects of these standards on anadromous fish. Also, the Temperature Criteria Development Project has an explicit goal of meeting the biological requirements of the listed anadromous fish species. Taken together, these measures have the potential to meet the biological requirements of the listed and proposed anadromous fish species beginning in the years 2000-2005, depending on the measure in question.

(5) Columbia River Chum Salmon

Chum salmon spawn in mainstem rivers or lower (usually) reaches of tributaries. In Oregon, chum salmon spawning populations remain only in the Lower Columbia River. There are no known runs remaining in Oregon tributaries to the Columbia (Johnson et al. 1997), although many of these tributaries likely are historic habitat. Spawning migrations to Washington tributaries of the Lower Columbia take place from late September to early December, depending on location. Cited adult migration temperatures are 8.3-15.6°C (Beschta et al. 1987) and 8.3-21.1°C (Bell 1991). Bell (1991) notes that adult migrations are blocked at the upper end of the range he reported.

Chum salmon are capable of adapting to seawater soon after emergence, and do not have a distinctive smolt stage (Salo 1991, Johnson et al.1997). Chum salmon fry generally migrate immediately after emergence (between March and June) to the estuary for rearing. Juvenile migration temperatures are in the range of 6.7-13.3°C, with an optimum of 10°C (Bell 1991). In Hokkaido, Japan, chum salmon migrate actively when stream temperatures reach 15°C, and leave the coastal area when temperature exceeds 17°C (Salo 1991).

Rearing temperature preferences of 14.1°C (Huntsman 1942, Ferguson 1958, Coutant 1977), 12-14°C (Brett 1952), and 11.2-14.6°C (Beschta et al. 1987) have been reported. The optimum temperature for rearing is 13.5°C (Beschta et al. 1987). The estuary temperature standard is not under review in this consultation.

In its BA, EPA found that exposing this species to this standard "poses a risk to their viability." The BA also states that "there is reason to believe that mortality from both lethal and sublethal effects (e.g., reproductive failure, prespawning mortality, residualization and delay of smolts,

decreased competitive success, disease resistance) will occur." EPA determined under the ESA that this standard was "likely to adversely affect" this species.

Although migrating adult and juvenile chum salmon require water that is cooler than the rearing temperature standard, known remaining populations of Lower Columbia chum salmon in Oregon are limited to the mainstem river, which is subject to a different rearing standard not currently
under review. If there are any unknown remnant populations of Columbia River chum salmon in Oregon tributaries to the Columbia River, or if they begin to reestablish themselves, their adult migration and most of their outmigration would be covered under the salmonid spawning temperature standard (12.8°C), which is in effect from September 15 to May 31 in the North Coast/Lower Columbia River basins, according to the ODEQ policy letter. Temperatures under the spawning temperature standard are likely to meet the biological requirements of this species for adult and juvenile migration.

6) Umpqua River sea-run cutthroat trout, and southwestern Washington/Columbia River coastal cutthroat trout:

Little temperature preference data is available for sea-run for cutthroat trout in general or for the subject species in particular. Most of the available data was gathered using resident, not sea-run fish. In the Umpqua River, cutthroat trout begin upstream migrations in late June and continue through January, with bimodal peaks in late July and October (Johnson et al.1994). In other streams, upstream migrations may occur from late June through the following April (Johnson et al. 1999). Cutthroat trout spawn in small, low-gradient streams, generally between December and May, with a peak in February (Johnson et al. 1994). Adult migration preference data specific to sea-run cutthroat trout were not found. A general preference of 9.4-12.8°C was given by Bell (1991). A maximum migration temperature for resident cutthroat trout of 10°C was reported by Spence et al. (1996). Umpqua River cutthroat trout occurred in upper reaches of Dumont Creek where water temperatures were 13.5°C, but were absent in the lower reaches where temperatures approached 18°C (Kruzic 1998).

Because cutthroat trout may hold for extended periods prior to spawning, adult holding temperatures are likely critical to successful reproduction. Similar effects as described for spring chinook salmon above are likely. Westslope cutthroat trout females held in fluctuating temperatures between 2°C and 10°C produced significantly better quality eggs than females held at a constant 10°C. Elevated temperatures experienced by mature females adversely affected subsequent viability and survival of embryos (Smith et al. 1983). Disease virulence and the risk of disease increases rapidly above 15.5-16.7°C (ODEQ 1995(b), McCullough 1999).

Cutthroat trout fry emerge from their redds between March and June, with peak emergence in mid-April (Johnson et al. 1994, 1999). Juveniles generally remain in upper tributaries until they are 1 year of age, when they may begin extensive up and down-stream migrations (Johnson et al. 1994, 1999). Preferred rearing temperatures for cutthroat trout have been reported at 9.5-12.9°C (Beschta et al. 1987), and 15°C (Heath 1963, as cited in Johnson et al. 1994).
Competitive abilities of salmonids can be affected by temperature. Juvenile steelhead production was the same at lower water temperatures (12-15°C) whether red shiners were present or not. At warmer water temperatures (19-22°C), steelhead production was lower when shiners were present compared to when shiners were absent (Reeves et. al. 1987).

Cutthroat trout migrate to the ocean beginning in March, with peaks in the Umpqua River system in May and June. Migrations to the ocean decline sharply in July, although some juveniles are still migrating through October (Johnson et al. 1994). Under Smoltification and Smolt Migration, ODEQ (1995(b)) states "It is recommended for all salmonids that temperature not exceed 54° F (12.2°C) to maintain the migratory response and seawater adaptation in juveniles..."

In its BA and BA amendment, EPA found that exposing these species to this standard "poses a risk to their viability." The BA also states that "there is reason to believe that mortality from both lethal and sublethal effects (e.g., reproductive failure, prespawning mortality, residualization and delay of smolts, decreased competitive success, disease resistance) will occur." EPA determined under the ESA that this standard was "likely to adversely affect" this species.

Based on the above information, water temperatures allowed under this standard are likely to cause lethal and sublethal adverse effects including: increased pre-hatch mortalities and developmental abnormalities, as well as smaller eggs and alevins, due to sub-optimal incubation temperatures for pre-spawning cutthroat adults; increased disease risk; reduced growth of juveniles; and delay, prevention or reversal of smoltification in late-migrating juveniles. Also, production of juveniles may further be reduced due to the out-migration of juveniles from areas made unsuitable for rearing by water temperatures, and by increased competition from other species at higher temperatures. Although attainment of the standard would represent a substantial improvement over the current environmental baseline in many watersheds, conditions in waters meeting this standard likely will not meet the biological requirements of Umpqua River cutthroat trout.

The EPA and ODEQ worked with the Services to develop measures intended to address adverse effects of the water temperature standards on the listed anadromous fish species (see discussion under section V.C.1.a.{2}, chinook salmon {above}, and Attachments 2, 3, and 4 of this Opinion). These conservation measures initiate processes through which EPA and NMFS anticipate development of additional guidance and

procedures about how some of the existing water temperature standards are applied, as well as eventual changes to the standards themselves. Although the final outcomes of these measures are not known, their intent is to minimize adverse effects of these standards on anadromous fish. Also, the Temperature Criteria Development Project has an explicit goal of meeting the biological requirements of the listed anadromous fish species. Taken together, these measures have the potential to meet the biological requirements of the listed and proposed anadromous fish species beginning in the years 2000-2005, depending on the measure in question.

b. Spawning Temperature Standard - 55.0°F (12.8°C)

(1) Snake River Sockeye Salmon, Upper Columbia River spring chinook salmon, and Upper Columbia River steelhead:

Snake River Sockeye Salmon, Upper Columbia River spring chinook salmon, and Upper Columbia River steelhead do not spawn in waters of the State of Oregon, so they are not subject to this standard. Therefore, the salmonid spawning temperature standard is not likely to adversely affect these species.

(2) Snake River spring/summer, Snake River fall, Upper Willamette River, Lower Columbia River, and Southern Oregon/California Coastal chinook salmon:

Literature reviewed by ODEQ (1995 b), Spence et al. 1996, McCullough 1997, and in the BA and its Appendix H indicate that the spawning standard would be protective of spring chinook spawning and incubation. Because most of the studies reviewed gave temperature ranges with an upper end somewhat higher than 12.8° C, temporary temperature increases due to the use of the seven-day moving average of the daily maximum as the measurement unit, while not an optimum situation, should not increase mortality significantly for chinook salmon. Although some of the available literature indicates fall chinook salmon may require water no warmer than 12°C for optimum incubation, this should not be a problem because these fish spawn after October 1, when water temperatures should be cool enough to avoid adverse effects. Fall temperature monitoring is needed to validate this assumption.

Although the numeric spawning criterion appears to be protective of these species, the identification of spawning and incubation areas in time and space affects the ability of this standard to avoid and minimize adverse effects. As discussed under the DO standard, NMFS has identified several problems with the state's salmonid spawning table. In particular, early spawning spring and summer chinook salmon are not protected.

Based on this information, NMFS concurs with EPA that the salmonid spawning temperature standard is not likely to adversely Snake River fall chinook salmon. However, NMFS does not concur with EPA's determination that the salmonid spawning temperature standard is not likely to adversely affect Snake River spring/summer, Upper Willamette River, Lower Columbia River, and Southern Oregon/California Coastal chinook salmon, because early spawning fish are not protected. Eggs and larvae of early spawning chinook salmon in these Oregon river basins are likely to suffer increased mortality under the rearing temperature standard, which would apply until the dates shown for ODEQ in Table 4.

The ODEQ has committed that, during the 1999-2002 Triennial Review, it will work with the Services, Oregon Department of Fish and Wildlife (ODFW), and others with relevant fish life history information to identify where and when the approved spawning criteria for temperature will apply (see measure 4 in Attachment 3 of this Opinion). Within one year of the final Opinion, DEQ will identify the geographic area and time periods to which the approved spawning criteria will apply in three pilot basins (18th watershed scale) identified by NMFS in this Opinion, provided adequate information is available

The ODEQ also will seek funding from EPA and the Services to expand water temperature monitoring into the spring (to include May and June) and fall (to include September and October) (see measure 7 in Attachment 3 of this Opinion). Upon receiving funding, ODEQ will begin to collect data to identify water bodies with threatened and endangered species that do not meet the water temperature standard for salmonid spawning and incubation. The ODEQ will work with the Services to identify target basins for spring and fall monitoring.

Although the final outcomes of these measures are unknown, these efforts have the potential to minimize the adverse effects described above for the spawning temperature standard. The ODEQ and EPA have agreed to meet twice a year with the Services to review progress in developing and applying this measure.

(3) Oregon Coast, and Southern Oregon/Northern California coho salmon:

Literature reviewed by ODEQ (1995 b), Spence et al. 1996, and in the BA and its Appendix H indicate that spawning temperature preferences and optimum incubation temperatures for coho salmon may be somewhat colder than the spawning temperature standard of 12.8° C. Cited maximum temperatures for spawning preference are in the range of 9.4-12.8°C. Cited maximum temperatures for optimum incubation are in the range of 6.5-13.3°C. Increased mortality of eggs has been reported at temperatures greater than maxima of 11-14°C. The possible difference between temperature needs of coho salmon and the spawning temperature standard (which is muddied by the range of

results reported in various studies) should not be a problem for most populations of coho salmon because these fish spawn in Oregon from mid-October to February (Weitkamp et al. 1995), when water temperatures should be cold enough to avoid adverse effects. Fall temperature monitoring is needed to validate this assumption.

NMFS concurs with EPA's determination that the salmonid spawning temperature standard is not likely to adversely affect Oregon Coast or Southern Oregon/Northern California coho salmon.

The EPA and ODEQ worked with the Services to develop measures intended to address adverse effects of the water temperature standards on anadromous fish (see discussion under section V.C.1.b.{2}, chinook salmon {above}, and Attachments 2, 3, and 4 of this Opinion). Although the final outcomes of these measures are unknown, they have the potential to minimize the adverse effects described above for the spawning temperature standard. The ODEQ and EPA have agreed to meet twice a year with the Services to review progress in developing and applying this measure.

(4) Snake River Basin, Middle and Lower Columbia River, and Upper Willamette River steelhead trout:

Literature reviewed by Spence et al. 1996, and in the BA and its Appendix H indicate that spawning temperature preferences for steelhead trout may be colder than the spawning temperature standard of 12.8°C, and optimum incubation temperatures likely are colder than the standard. This should not be a problem for steelhead trout populations that spawn between winter and spring, when water temperatures should be cold enough to avoid adverse effects. Based on this information, NMFS does not concur with EPA's determination that the salmonid spawning temperature standard is not likely to adversely Snake River Basin, Middle and Lower Columbia River, and Upper Willamette River steelhead, because late spawning fish are not protected. Eggs and larvae of late-spawning steelhead trout in Oregon river basins within these ESUs are likely to suffer increased mortality under the spawning temperature standard, which would apply until the dates shown for ODEQ in Table 4.

The EPA and ODEQ worked with the Services to develop measures intended to address adverse effects of the water temperature standards on anadromous fish (see discussion under section V.C.1.b.{2}, chinook salmon {above}, and Attachments 2, 3, and 4 of this Opinion). Although the final outcomes of these measures are unknown, they have the potential to minimize the adverse effects described above for the spawning temperature standard. The ODEQ and EPA have agreed to meet twice a year with the Services to review progress in developing

and applying this measure.

(5) Columbia River Chum Salmon

Literature reviewed by Spence et al. 1996, and in the BA and its Appendix H indicate that spawning temperature preferences for chum salmon would be protected by the spawning temperature standard of 12.8° C. Optimum incubation temperatures likely are somewhat colder than the standard. However, this should not be a problem for chum salmon because these fish generally spawn between October and December, when water temperatures should be cold enough to avoid adverse effects. Fall temperature monitoring is needed to validate this assumption. NMFS concurs with EPA's determination that the salmonid spawning temperature standard is not likely to adversely affect Columbia River chum salmon.

6) Umpqua River sea-run cutthroat trout, and southwestern Washington/Columbia River coastal cutthroat trout:

A preferred spawning temperature range of 6.1-17.2° C is reported for cutthroat trout in general (Beschta et al. 1987, Bell 1991). Preferred spawning temperature ranges of 4.4-12.8° C and 5.5-15.5° C have been reported for resident cutthroat trout (Spence et al. 1996). Although the numeric spawning criterion appears to be protective of these species, the identification of spawning and incubation areas in time and space affects the ability of this standard to avoid and minimize adverse effects. Eggs and larvae of late-spawning individuals within both of these ESUs are likely to suffer increased mortality under the spawning temperature standard, which would apply until the dates shown for ODEQ in Table 4. Because of this, NMFS does not concur with EPA's determination that the salmonid spawning temperature standard is not likely to adversely affect Umpqua River sea-run cutthroat trout and southwest Washington/Columbia River coastal cutthroat trout.

The EPA and ODEQ worked with the Services to develop measures intended to address adverse effects of the water temperature standards on anadromous fish (see discussion under section V.C.1.b.{2}, chinook salmon {above}, and Attachments 2, 3, and 4 of this Opinion). Although the final outcomes of these measures are unknown, they have the potential to minimize the adverse effects described above for the spawning temperature standard. The ODEQ and EPA have agreed to meet twice a year with the Services to review progress in developing and applying this measure.

7) Identification of pilot basins for identification of where and when the approved spawning criteria will

apply:

ODEQ measure 4 states that within one year of the final BO, DEQ will identify the geographic area and time periods to which the approved spawning criteria will apply in three pilot basins (18th watershed scale) identified by NMFS in this Opinion, provided adequate information is available. Based on the information contained in Table 4 of this Opinion, the Hood River drainage, John Day River, and Grande Ronde River represent basins where current application of the spawning standard presents the greatest risk to listed anadromous fish, and should be used as the pilot basins for this effort.

c. Narrative Temperature Criteria

Narrative criteria state verbally what conditions or limits will apply, but need to be determined on a case-by-case basis. The narrative criteria allow "no measurable surface water temperature increase resulting from anthropogenic activities...

(vi) In waters determined by the Department to be ecologically significant cold-water refugia;

(vii) In stream segments containing federally listed Threatened and Endangered species if the increase would impair the biological integrity of the Threatened and Endangered population;

(viii) In Oregon waters when the dissolved oxygen (DO) levels are within 0.5 mg/L or 10 percent saturation of the water column or intergravel DO criterion for a given stream reach or subbasin;

(ix) In natural lakes."

1. Effects on sockeye salmon (Snake River), Chinook Salmon (Snake River fall and spring/summer, Upper Willamette River, Upper Columbia River Spring Run, Lower Columbia River, and Southern Oregon/California Coastal), Coho Salmon (Lower Columbia River and Southwest Washington, Coastal, and Southern Oregon/Northern California), Columbia River Chum Salmon, Steelhead Trout (Snake River Basin, Upper, Middle, and Lower Columbia River, and Upper Willamette River), and cutthroat trout (Umpqua River sea-run, and southwestern Washington/Columbia River):

The BA states that the ODEQ will apply provision (vi) above using the following definition: "Ecologically Significant Cold-Water Refuge" exists when all or a portion of a waterbody supports stenotypic cold-water species (flora or fauna) not otherwise widely supported within the subbasin, and either: (a) maintains cold-water temperatures throughout the year relative to other segments in the subbasin, providing summertime cold-water holding or rearing habitat that is limited in supply, or; (b) supplies cold water to a receiving stream or downstream reach that supports cold-water biota.

Refugia at various scales may reduce or eliminate exposure to sublethal and lethal temperatures. Additionally, refugia may serve as source areas for recolonization subsequent to disturbance events (BA Appendix H). The effectiveness of this criterion depends on the definition and identification process for cold-water refugia. The first part of the definition may be overly restrictive, because it requires that the waterbody in question supports stenotypic cold-water species *not otherwise widely supported in the subbasin*. This implies that a few cold-water refugia per subbasin are sufficient, and that subbasins are the relevant scale to use when judging whether a waterbody qualifies as a refugium. However, ecologically significant cold-water refugia may be present at multiple scales from small 6th field subwatersheds through 4th field subbasins. Refugia may form at localized micro-habitats and zones generated by riparian structure, floodplains, hyporheic zones, and ground water input, as well as at macro-habitat features such as reaches, tributaries, and subbasins (Sedell et al. 1990, Berman and Quinn 1991 as cited in BA Appendix H). The ODEQ has not prepared guidance for designation of cold-water refugia (Deb Sturdevant, ODEQ, pers. comm. with Jeffrey Lockwood, NMFS, October 30, 1998).

The BA states that ODEQ will apply provision (vii) when they have specific temperature information for a listed species. However, the ODEQ has not prepared guidance or implementation procedures regarding how the determination regarding impairment of biological integrity would be made. Measurable increase in stream temperatures would almost always impair the biological integrity of threatened and endangered anadromous fish species in Oregon, since most are not only living near the southern end of their ranges, but are facing widespread anthropogenic warming of their habitats (ODEQ 1995 (b)). Even in the presumably few reaches that are too cold for optimal growth of anadromous fish, increases that could locally improve anadromous fish production or increase the upstream extent of occupied habitat could have harmful effects in other areas due to the transport of heat downstream. Another weakness of this criterion is that it does not protect federally proposed or candidate species - only listed species.

Application of provision (viii) resulted in the placement of several waters on the draft 1998 303(d) listing of water quality limited water bodies. In those cases the DO measurements were the trigger for the listing for temperature. This provision appears to be helping to avoid and

minimize adverse effects to anadromous fish.

Not all policies, guidelines and implementation program elements fall under the purview of the CWA Section 303(c) water quality standards review. Within each basin's standards in OAR 340-41 there is a provision to not count an exceedance of surface water temperature criteria an exceedance if it occurs "when the air temperature during the warmest seven-day period of the year exceeds the 90th percentile of the seven-day average daily maximum air temperature calculated in a yearly series over the historic record." This is enforcement/compliance discretion EPA allows to the state. EPA conferred with the state regarding how this provision was being implemented. According to the EPA, the ODEQ noted that no waterbodies were removed from the 1998 303(d) list because of this provision. Although NMFS is concerned that this provision could result in some future inappropriate removals from the 303(d) list, the action is not under review and therefore not part of this consultation.

The temperature standards also contain a provision to allow a source an exception from the numeric and narrative criteria if "designated beneficial uses would not be adversely impacted; or a source is implementing all reasonable management practices or measures; its activity will not signficantly affect the beneficial uses; and the environmental cost of treating the parameter to the level necessary to assure full protection would outweigh the risk to the resource." The state has clarified in its policy letter that this will be handled as a variance for that source until a TMDL is developed or a site-specific criterion will be developed for the water body. In the former case, the documentation to support a variance must meet the requirements of the federal regulations found at 40CFR131.10(g), which require a demonstration of why the criteria to support the use cannot be met. For a site-specific criterion, the documentation must follow one of EPA's approved methods for site-specific criteria development or some other scientifically defensible method (40CFR131.11(b)). In either case a public review process would be required, as well as submittal of the site-specific criterion to EPA for review, approval, and consultation under section 7 of ESA.

The narrative temperature criterion for marine and estuarine waters was not changed and therefore is not part of this EPA action.

In a section of the Oregon water quality standards entitled "Policies and Guidelines Generally Applicable to all Basins" there are provisions directing that anthropogenic sources "develop and implement a surface water temperature management plan describing the best management practices, measures and/or other control technologies which will be used to reverse the warming trend of the basin, watershed, or stream segment" (OAR 340-41-026 (3)(a)(D)(i)). These sources are to "continue to maintain and improve" the plan in order to maintain the cooling trend until the criterion is achieved or the ODEQ has determined that "all feasible steps have been taken to meet the criterion and that the designated beneficial uses are not being adversely impacted." The "temperature achieved" will then be the temperature criterion for the surface

waters covered by the plan. In its policy letter the ODEQ has clarified that in this circumstance the ODEQ will develop a site-specific criterion (which is a change in the water quality standards) that will be submitted to EPA for review, approval and consultation under section 7 of ESA.

The Policies and Guidelines section also contain provisions F, G and H that allow a source (or sources cumulatively) to increase the waterbody temperature by a set amount while a TMDL is developed, as long as the increase will not "conflict with or impair the ability of a surface water temperature management plan to achieve the temperature criteria" ultimately and will not "result in a measurable impact on beneficial uses" or "beneficial uses would not be adversely impacted." The ODEQ's policy letter indicates that provisions F and G will result in permits written to bring the water body back into compliance and meet the criteria. Provision H will be handled as a variance which will be submitted to EPA for review, approval, and consultation under section 7 of ESA each time it is applied to a particular permit.

The provisions in OAR 340-41-120, Implementation Program Applicable to all Basins, include statements of policy (e.g. regarding minimizing risk to cold-water aquatic ecosystems) and implementation, particularly for waters exceeding the applicable numeric criterion. These provisions do not fall under the purview of the CWA Section 303(c) review as they do not explicitly pertain to designation of uses, criteria, antidegradation policy, or other aspects of the water quality standards program that are specified for review under the EPA water quality standards regulations at 40 CFR 131. Provision (11)(c) in this section of the Oregon regulations allows the natural surface water temperature to become the numeric criterion. While this does pertain to a standard change, and is of concern to NMFS due to the lack of implementation guidance, it is not a change from previous provisions in Oregon's water quality standards and therefore is not being reviewed in this action. The concluding provision (g) of this section addresses maintaining "low stream temperatures to the maximum extent practicable" and emphasizes that any measurable increase in surface water temperature resulting from anthropogenic activities "shall be in accordance with the antidegradation policy contained in OAR 340-41-026." NMFS is concerned that ODEQ has not issued implementation procedures for its antidegradation policy.

NMFS acknowledges that the narrative criteria provide the state with the legal authority to provide extra protection beyond the numeric criteria where warranted. Nevertheless, there are some problems with how the narrative standards are written. Also, the lack of implementation procedures or guidance for many of these standards has contributed to a lack of implementation.

ODEQ has developed conservation measures (see measures 1 and 3 in Attachment 3 of this Opinion) that will address weaknesses in the narrative standards. ODEQ will develop guidance on the application of the narrative criteria in the T standard for threatened and endangered species and for cold water refugia by June 1, 2000. ODEQ will involve NMFS and the EPA in scoping, development, and review of the draft

guidance. Should additional rulemaking be required to identify cold water refugia or areas where the narrative standards will apply, that rulemaking will occur in the 1999-2002 Triennial Review. If it appears that these narrative standards will not be included in the Regional Temperature Criteria Development Project, and the Services agree, this measure becomes moot and will not be completed. The ODEQ also will develop a plan for the implementation of the antidegradation policy by December 31, 2000. The ODEQ will involve NMFS and the EPA in scoping and review of the draft guidance, will provide an informal response to comments. ODEQ anticipates applying the anti-degradation policy to NPDES permits as they are renewed following completion of the guidance.

These conservation measures initiate processes through which EPA and NMFS anticipate development of additional guidance and procedures about how some of the existing narrative criteria are applied, as well as possible eventual changes to some of the criteria themselves. Although the final outcomes of these measures are not known, their intent is to address problems in the narrative criteria.

The narrative criteria provide the state with the legal authority to provide extra protection beyond the numeric criteria where warranted. Although there are weaknesses in some of the narrative criteria, any adverse effects where they are applied can be attributed to the underlying problems with the numeric standards that the narrative criteria attempt to correct. The ODEQ has committed to working with the Services and EPA to address the problems in the narrative criteria. Based on the above information, NMFS concurs with the EPA determinations that the narrative criteria are not likely to adversely affect Chinook Salmon (Snake River fall and spring/summer, spring run Upper Willamette River, spring run Upper Columbia River, all runs of Lower Columbia River, spring and fall runs of Southern Oregon/California Coastal), Coho Salmon (Lower Columbia River and Southwest Washington, Coastal, and Southern Oregon/Northern California), Columbia River Chum Salmon, Steelhead Trout (Snake River Basin, Upper, Middle, and Lower Columbia, Upper Willamette, Oregon Coast, and Klamath Mountains Province), Umpqua River sea-run cutthroat trout, or southwestern Washington/Columbia River coastal cutthroat trout.

D. Hydrogen Ion Concentration (pH) Standards

The BA contains information on how the previous standards were revised and on the objectives of the revisions. The Oregon pH water quality standards are included in Appendix B of the BA, and are summarized below. ODEQ already is implementing the revised standards.

1. Background on pH

The pH is a measure of the concentration (activity) of hydrogen, or hydronium, ions in water. Specifically, pH is the negative log of the hydrogen ion concentration. The pH of natural waters reflects the acid-base equilibrium achieved by various dissolved solids and gases, and is an important factor in the chemical and biological interactions found in waterbodies. On the pH scale of 0-14, waters of 0-7 are acidic, and waters from 7-14 are alkaline. Elevated hydrogen ion concentrations at low pH are directly toxic to fish, causing osmoregulatory problems (ODEQ 1995(c)). Changes in pH also affect the solubility or toxicity of metals such as aluminum, manganese, zinc, copper, and cadmium in the water column and sediments, thereby affecting the exposure dose of metals to aquatic organisms (ODEQ 1995(c)). Aluminum is the metal of greatest concern at low pH values. Un-ionized ammonia, which is directly toxic to aquatic organisms, is a problem at higher pH values. At a given temperature, the higher the pH, the greater the amount of un-ionized ammonia that will be present for a given amount of total ammonia (ODEQ 1995(c)).

Rainwater without anthropogenic acids has a pH generally between 5.0 and 5.6 (ODEQ 1995c). The buffering capacity of a waterbody is related to alkalinity, a trait that is determined by soil type and parent geology. Waters with high alkalinity are able to neutralize or buffer a certain amount of acidic inputs. Buffering capacity in Oregon water generally increases from west to east across the state. Many basins in the Coast Range are poorly buffered and tend to reflect the effect of acidic rainwater through lower pH, particularly during the rainy season. Eastside basins tend to have more alkaline-producing geology such as limestone formations, contributing to higher pH (ODEQ 1995c). Discharge of water from reservoirs also affects alkalinity in downstream waters. Typically, reservoir water is stored up during spring runoff and has a low alkalinity. Alkalinities are lowest during periods of high surface runoff (winter and spring) and highest during periods when groundwater discharge dominates stream flow (summer and fall) (ODEQ 1995c).

Human activities, such as acid drainage from mines, may lower pH in affected waterbodies. Other anthropogenic influences such as higher salt (e.g., calcium) loads from agricultural runoff may also raise pH. Nutrients from fertilizers or animal waste in runoff can cause increased algal growth, reducing the water column CO_2 concentration, which raises the pH during the day. At night, plant respiration may sharply lower the pH, causing large diurnal pH swings in highly productive waters. Riparian vegetation removal by grazing and other management activities would tend to increase primary production and exacerbate pH swings. Diurnal fluctuations vary seasonally, and are most distinct primarily in the summer and fall.

1. Effects on chinook salmon (Southern Oregon/California Coastal), coho salmon (Southwest Washington/Lower Columbia River, Oregon Coast, and Southern Oregon/Northern California), Columbia River chum salmon, steelhead trout (Oregon Coast), and cutthroat trout (Umpqua River sea-run, and southwestern Washington/lower Columbia River coastal):

These species occur in watersheds subject to the following pH standards:

Marine waters: pH 7.0 to 8.5
Estuarine and fresh waters: pH 6.5 to 8.5*

**Exception applying to all Basins*: Waters impounded by dams existing on January 1, 1996, which have pHs that exceed the criteria shall not be considered in violation of the standard if the Department determines that the exceedance would not occur without the impoundment and that all practicable measures have been taken to bring the pH in the impounded waters into compliance with the criteria.

There is little species-specific information for pH effects on anadromous fish. ODEQ (1995 (c)) summarized results from reports synthesized by the National Acid Precipitation Assessment Program regarding effects of acidification of surface waters on aquatic biota. In the pH range of 6.5 to 6.0, anticipated effects are a small decrease in species richness of phytoplankton, zooplankton, and benthic invertebrate communities resulting from the loss of a few highly acid-sensitive species, but no measurable change in community abundance or production. Highly acid-sensitive fish species (e.g. fathead minnow and striped bass) may suffer decreased reproductive success. Below pH 6.0, reproductive success of lake trout declines in some waters, and lake and rainbow trout are lost from aquatic habitats at pH 5.5 to 5.0 (ODEQ 1995(c)).

Davidson (1933, as cited in Heard 1991) reported a kill of pink salmon and other fish in an Alaska stream due to carbon dioxide asphyxiation where pH temporarily dropped to 5.6. Vulnerable life stages of chinook salmon are sensitive to pH below 6.5 and possibly at pH greater than 9.0 (Marshall et al. 1992, as cited in the BA). Considering the salmonid food base, some insect larvae including those of the mayflies, stoneflies, and caddis flies are sensitive to low pH in the range of 5.5 to 6.0 (ODEQ, 1995(c)).

Based on the information above, pH in Oregon waterways meeting the low end of the pH standard (pH 6.5) is not likely to adversely affect the above anadromous fish species. At the high end of the pH scale, EPA's recommended upper limit of 9.0 (EPA 1986) was obtained from only one reference from 1969. According to the BA, pH greater than 9.0 may adversely affect benthic invertebrate populations, changing the food base for salmonids. Studies conducted earlier in the century show salmonids, including both trout and salmon species, to be sensitive to pH in the range of 9.2 to 9.7, depending on the life stage (ODEQ, 1995(c)). Erichsen Jones (1964) reported that rainbow trout could tolerate pH up to 9.8. More recent data indicate rainbow trout can survive in water with a constant pH of 9.5 for at least 72 hours, although marked disturbances in ammonia excretion, acid-base balance, and ionoregulation may render the fish more susceptible to death from other causes

(Wilkie and Wood 1991). More than 50% of Lahontan cutthroat trout acclimated to an alkaline lake (pH 9.4) died after a 72-hour constant exposure to water at pH 10. Physiological data suggest the fish may have died from ammonia toxicity and ionoregulatory failure (Wilkie et al.1993). Based on the information above, the pH in Oregon waterways meeting the high end standard of pH 8.5 is not likely to adversely affect the above anadromous fish species.

2 Effects on chinook salmon (Snake River spring/summer and fall), and steelhead trout (Middle Columbia, and Snake River Basin):

These species occur in watersheds subject to the following pH standards:

John Day, Umatilla, Grande Ronde, Walla Walla, and Powder river basins:
pH 6.5 to 9.0*

* when greater than 25% of ambient measurements taken between June and September are greater than pH 8.7, and as resources are available according to priorities set by the Department, the Department shall determine whether the values higher than 8.7 are anthropogenic or natural in origin.

These species also are subject to the below standards when migrating through the Snake River (all except middle-Columbia River steelhead), the Columbia River, and the Lower Columbia River and its estuary:

Snake River: 7.0 to 9.0*
Columbia River: 7.0 to 8.5
Lower Columbia River:
Estuarine and fresh waters: pH 6.5 to 8.5
Marine waters: pH 7.0 to 8.5

* The Snake River pH standard was not changed and is not a subject of EPA's approval action or this consultation.

Based on the information above, the pH in Oregon waterways meeting the low end pH standard of pH 6.5 to 7.0, or in waterways meeting the high end pH standard of pH 8.5, is not likely to adversely affect the above anadromous salmonids. Regarding the high end pH standard of pH

9.0, NMFS agrees with the BA that a pH of 9.0 seems to be the cutoff for the start of adverse effects for some species of salmonids and their invertebrate food sources. Although significant mortality of listed and proposed species does not appear likely, there is no reliable margin of safety at pH 9.0, as is stated in the BA. Although the standard allows an investigation by ODEQ when greater than 25% of ambient measurements taken between June and September are greater than pH 8.7 to determine whether the values higher than 8.7 are anthropogenic or natural in origin, the standard is worded so the investigation is optional. Also, there is no requirement for ODEQ to place the waterbody on the 303(d) list if it does an investigation and finds that the pH over 8.7 is anthropogenic in origin.

3. Effects on Snake River sockeye salmon, Upper Columbia River chinook salmon, and Upper Columbia River steelhead trout:

These species are not subject to fresh water pH standards in Oregon, except when migrating in the Snake (Snake River Sockeye Salmon) and Columbia Rivers. In those waters, these species would be subject to the following pH standards:

Snake River: 7.0 to 9.0*

Columbia River: 7.0 to 8.5

Lower Columbia River and its estuary:
Estuarine and fresh waters: pH 6.5 to 8.5

Marine waters: pH 7.0 to 8.5

* The Snake River pH standard was not changed and is not a subject of EPA's approval action or this consultation.

Based on the information above, the pH in Oregon waterways meeting the pH standard in the range of pH 6.5 to 8.5 is not likely to adversely affect the anadromous salmonids listed above.

VI. Cumulative Effects

Cumulative Effects. "Cumulative effects" are defined as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation" (50 CFR § 402.02). Future Federal actions, including the ongoing operation of hydropower systems, hatcheries, fisheries, and land management activities are being (or have been) reviewed through separate section 7 consultation processes. In addition, non-Federal actions that receive authorization under section 10 of the ESA will be evaluated separately. Therefore, these actions are not considered cumulative to the proposed action.

Information on specific activities planned or foreseeable on non-Federal land was not provided in the BA, nor could NMFS reasonably expect EPA to do so for such a large action area. The NMFS is not aware of any future new (or changes to existing) State and private activities within the action area that would cause greater impacts to the proposed and listed species than presently occurs. The NMFS assumes that management impacts from non-Federal activities which have degraded or hindered recovery of anadromous fish habitat will continue in the short term at similar intensities as in recent years. This assumption may be conservative in the long-term, given development of non-Federal conservation programs, such as the Oregon Plan for Salmon and Watersheds, and possible development of habitat conservation plans with non-Federal entities to fulfill the requirements of section 10 of the ESA.

VII. Conclusion

A. Dissolved Oxygen (DO) Standards

The NMFS has determined, based on the information, analysis, and assumptions described in this Opinion, that EPA's proposed approval of the State of Oregon's DO standards for salmonid spawning and incubation, cold water aquatic life, and cool water aquatic life, is not likely to jeopardize the continued existence of the listed or proposed species or result in the destruction or adverse modification of designated critical habitat. In arriving at this determination, NMFS considered the current status of the listed and proposed salmonid ESUs; environmental baseline conditions; the direct and indirect effects of approving the standards; whether waters meeting the standards would meet the biological requirements of the listed and proposed species at both the individual and population levels; commitments by EPA and the Oregon Department of Environmental Quality to implement certain conservation measures (described in Attachments 2 through 4 of this opinion); and the cumulative effects of actions anticipated in the action area.

The IGDO standard of 8 mg/l, and the water column DO standard for spawning and incubation, are likely to adversely affect the following species, and result in their incidental take, because they do not protect early and late spawning adults, embryos and larvae:

Snake River spring/summer and fall chinook salmon (both threatened), Southern Oregon/Northern California Coastal chinook salmon (proposed threatened), Upper Willamette River chinook salmon (threatened), Snake River steelhead trout (threatened), Upper Willamette River steelhead trout (threatened), Middle Columbia River steelhead trout (threatened), Lower Columbia River steelhead trout (threatened), Umpqua River sea-run cutthroat trout, and southwestern Washington/Columbia River coastal cutthroat trout (proposed threatened).

The provision in the cold-water DO standard of 6.5 mg/l as a seven-day minimum mean, 6.0 mg/l as an absolute minimum, is likely to adversely affect adult and juveniles of the following species, and result in their incidental take: southwest Washington/Lower Columbia River coho salmon (candidate), Oregon Coast and Klamath Mountains Province steelhead (candidate), southern Oregon/northern California coastal chinook salmon (proposed threatened), and southwestern Washington/Columbia River coastal cutthroat trout (proposed threatened).

The cool-water DO standard is likely to adversely affect the following species, and result in their incidental take, because it will apply in migratory corridors, or in rearing and migratory habitat: Columbia River chum salmon (threatened), southwestern Washington/Columbia River coastal cutthroat trout (proposed threatened), Lower Columbia River chinook (threatened), Lower Columbia River steelhead (threatened), Upper Willamette River steelhead (threatened), Upper Willamette River chinook (threatened), Middle Columbia River steelhead (threatened), Snake River spring/summer and fall chinook (both threatened), and Snake River steelhead (threatened).

Take associated with EPA's approval of the DO standards is not likely to be of a magnitude or duration that would appreciably diminish the likelihood of survival and recovery of these species, nor is it likely to result in destruction or adverse modification of critical habitat. Development and application of the reasonable and prudent measure identified in the Incidental Take Statement (section X, below) has the potential to minimize adverse effects from approval of the DO standards.

B. Water Temperature Standards

1) Rearing standard

a. Snake River sockeye salmon, Upper Columbia River spring chinook salmon, and Upper Columbia River steelhead:

The NMFS has determined, based on the information, analysis, and assumptions described in this Opinion, that EPA's proposed approval of the State of Oregon's water temperature standard for salmonid rearing is not likely to jeopardize the continued existence of Snake River sockeye salmon, Upper Columbia River spring chinook salmon, or Upper Columbia River steelhead, or result in the destruction or adverse modification of designated critical habitat. In arriving at this determination, NMFS considered the current status of the listed salmonid ESUs; environmental baseline conditions; the direct and indirect effects of approving the standards; whether waters meeting the standards would meet the biological requirements of the listed and proposed species at both the individual and population levels; commitments by EPA and the Oregon Department of Environmental Quality to implement certain conservation measures (described in Attachments 2 through 4 of this opinion); and the cumulative effects of actions anticipated in the action area.

b. Snake River spring/summer, Snake River fall, Upper Willamette River, Lower Columbia River, and Southern Oregon/California Coastal chinook salmon (proposed):

The NMFS has determined, based on the information, analysis, and assumptions described in this Opinion, that EPA's proposed approval of the State of Oregon's rearing temperature standard is not likely to jeopardize the continued existence of Snake River spring/summer, Snake River fall, Upper Willamette River, Lower Columbia River, and Southern Oregon/California Coastal chinook salmon, or result in the destruction or adverse modification of designated critical habitat. In arriving at this determination, NMFS considered the current status of the listed and proposed salmonid ESUs; environmental baseline conditions; the direct and indirect effects of approving the standards; whether waters meeting the standards would meet the biological requirements of the listed and proposed species at both the individual and population levels; commitments by EPA and the Oregon Department of Environmental Quality to implement certain conservation measures (described in Attachments 2 through 4 of this opinion); and the cumulative effects of actions anticipated in the action area.

NMFS has determined that EPA's approval of the rearing temperature standard is likely to adversely affect the following species, and result in their incidental take: Snake River spring/summer, Snake River fall, Upper Willamette River, Lower Columbia River, and Southern Oregon/California Coastal chinook salmon. Take associated with EPA's approval of the rearing temperature standard is not likely to be of a duration that would appreciably diminish the likelihood of survival and recovery of these species, nor is it likely to result in destruction or adverse modification of critical habitat. Development and application of the reasonable and prudent measure identified in the Incidental Take Statement (section X, below) has the potential to minimize adverse effects from approval of the rearing temperature standard.

c. Oregon Coast, and Southern Oregon/Northern California coho salmon:

The NMFS has determined, based on the information, analysis, and assumptions described in this Opinion, that EPA's proposed approval of the State of Oregon's water temperature standard for salmonid rearing is not likely to jeopardize the continued existence of Oregon Coast, or southern Oregon/Northern California coho salmon, or result in the destruction or adverse modification of designated critical habitat. In arriving at this determination, NMFS considered the current status of the listed salmonid ESUs; environmental baseline conditions; the direct and indirect effects of approving the standards; whether waters meeting the standards would meet the biological requirements of the listed and proposed species at both the individual and population levels; commitments by EPA and the Oregon Department of Environmental Quality to implement certain conservation measures (described in Attachments 2 through 4 of this opinion); and the cumulative effects of actions anticipated in the action area.

NMFS has determined that EPA's approval of the rearing temperature standard is likely to adversely affect the following species, and result in their incidental take: Oregon Coast, and southern Oregon/Northern California coho salmon. Take associated with EPA's approval of the rearing temperature standard is not likely to be of a duration that would appreciably diminish the likelihood of survival and recovery of these species, nor is it likely to result in destruction or adverse modification of critical habitat. Development and application of the reasonable and prudent measure identified in the Incidental Take Statement (section X, below) has the potential to minimize adverse effects from approval of the rearing temperature standard.

d. Snake River Basin, Middle and Lower Columbia River, and Upper Willamette River steelhead trout:

The NMFS has determined, based on the information, analysis, and assumptions described in this Opinion, that EPA's proposed approval of the State of Oregon's water temperature standard for salmonid rearing is not likely to jeopardize the continued existence of Snake River Basin, Middle and Lower Columbia River, or Upper Willamette River steelhead trout, or result in the destruction or adverse modification of designated critical habitat. In arriving at this determination, NMFS considered the current status of the listed salmonid ESUs; environmental baseline conditions; the direct and indirect effects of approving the standards; whether waters meeting the standards would meet the biological requirements of the listed and proposed species at both the individual and
population levels; commitments by EPA and the Oregon Department of Environmental Quality to implement certain conservation measures (described in Attachments 2 through 4 of this opinion); and the cumulative effects of actions anticipated in the action area.

NMFS has determined that EPA's approval of the rearing temperature standard is likely to adversely affect the following species, and result in their incidental take: Snake River Basin, Middle and Lower Columbia, and Upper Willamette River steelhead trout. Take associated with EPA's approval of the rearing temperature standard is not likely to be of a duration that would appreciably diminish the likelihood of survival and recovery of these species, nor is it likely to result in destruction or adverse modification of critical habitat. Development and application of the reasonable and prudent measure identified in the Incidental Take Statement (section X, below) has the potential to minimize adverse effects from approval of the rearing temperature standard.

e. Columbia River Chum Salmon

The NMFS has determined, based on the information, analysis, and assumptions described in this Opinion, that EPA's proposed approval of the State of Oregon's water temperature standard for salmonid rearing is not likely to jeopardize the continued existence of Columbia River chum salmon, or result in the destruction or adverse modification of designated critical habitat. In arriving at this determination, NMFS considered the current status of the listed salmonid ESUs; environmental baseline conditions; the direct and indirect effects of approving the standards; whether waters meeting the standards would meet the biological requirements of the listed and proposed species at both the individual and population levels; commitments by EPA and the Oregon Department of Environmental Quality to implement certain conservation measures (described in Attachments 2 through 4 of this opinion); and the cumulative effects of actions anticipated in the action area.

f. Umpqua River sea-run cutthroat trout, and southwestern Washington/Columbia River coastal cutthroat trout:

The NMFS has determined, based on the information, analysis, and assumptions described in this Opinion, that EPA's proposed approval of the State of Oregon's water temperature standard for salmonid rearing is not likely to jeopardize the continued existence of Umpqua River sea-run cutthroat trout, or result in the destruction or adverse modification of designated critical habitat. In arriving at this determination, NMFS considered the current status of the listed salmonid ESUs; environmental baseline conditions; the direct and indirect effects of approving the standards; whether waters meeting the standards would meet the biological requirements of the listed and proposed species at both the individual and population levels; commitments by EPA and the Oregon Department of Environmental Quality to implement certain conservation measures (described in Attachments 2 through 4 of this opinion); and the cumulative effects of actions anticipated in the action area.
NMFS has determined that EPA's approval of the rearing temperature standard is likely to adversely affect the following species, and result in their incidental take: Umpqua River sea-run cutthroat trout, and southwest Washington/Columbia River coastal cutthroat trout. Take associated with EPA's approval of the rearing temperature standard is not likely to be of a duration that would appreciably diminish the

likelihood of survival and recovery of these species, nor is it likely to result in destruction or adverse modification of critical habitat. Development and application of the reasonable and prudent measure identified in the Incidental Take Statement (section X, below) has the potential to minimize adverse effects from approval of the rearing temperature standard.

2) Spawning standard

a. Snake River Sockeye Salmon, Upper Columbia River spring chinook salmon, and Upper Columbia River steelhead:

The NMFS has determined, based on the information, analysis, and assumptions described in this Opinion, that EPA's proposed approval of the State of Oregon's spawning temperature standard is not likely to jeopardize the continued existence of Snake River Sockeye Salmon, Upper Columbia River spring chinook salmon, or Upper Columbia River steelhead, or result in the destruction or adverse modification of designated critical habitat. In arriving at this determination, NMFS considered the current status of the listed and proposed salmonid ESUs; environmental baseline conditions; the direct and indirect effects of approving the standards; whether waters meeting the standards would meet the biological requirements of the listed and proposed species at both the individual and population levels; commitments by EPA and the Oregon Department of Environmental Quality to implement certain conservation measures (described in Attachments 2 through 4 of this opinion); and the cumulative effects of actions anticipated in the action area.

b. Snake River spring/summer, Snake River fall, Upper Willamette River, Lower Columbia River, and Southern Oregon/California Coastal chinook salmon:

The NMFS has determined, based on the information, analysis, and assumptions described in this Opinion, that EPA's proposed approval of the State of Oregon's spawning temperature standard is not likely to jeopardize the continued existence of Snake River spring/summer, Snake River fall, Upper Willamette River, Lower Columbia River, or Southern Oregon/California Coastal chinook salmon, or result in the destruction or adverse modification of designated critical habitat. In arriving at this determination, NMFS considered the current status of the listed and proposed salmonid ESUs; environmental baseline conditions; the direct and indirect effects of approving the standards; whether waters meeting the standards would meet the biological requirements of the listed and proposed species at both the individual and population levels; commitments by EPA and the Oregon Department of Environmental Quality to implement certain conservation measures (described in Attachments 2 through 4 of this opinion); and the cumulative effects of actions anticipated in the action area.

NMFS has determined that EPA's approval of the spawning temperature standard is likely to adversely affect the following species, and result in their incidental take, because early spawning spring and summer chinook salmon are not protected: Snake River spring/summer, Upper Willamette River, Lower Columbia River, and Southern Oregon/California Coastal chinook salmon. Take associated with EPA's approval of the spawning temperature standard is not likely to be of a duration that would appreciably diminish the likelihood of survival and recovery of these species, nor is it likely to result in destruction or adverse modification of critical habitat. Development and application of the reasonable and prudent measure identified in the Incidental Take Statement (section X, below) has the potential to minimize adverse effects from approval of the spawning temperature standard.

c. Oregon Coast, and Southern Oregon/Northern California coho salmon:

The NMFS has determined, based on the information, analysis, and assumptions described in this Opinion, that EPA's proposed approval of the State of Oregon's spawning temperature standard is not likely to jeopardize the continued existence of Oregon Coast, or Southern Oregon/Northern California coho salmon, or result in the destruction or adverse modification of designated critical habitat. In arriving at this determination, NMFS considered the current status of the listed and proposed salmonid ESUs; environmental baseline conditions; the direct and indirect effects of approving the standards; whether waters meeting the standards would meet the biological requirements of the listed and proposed species at both the individual and population levels; commitments by EPA and the Oregon Department of Environmental Quality to implement certain conservation measures (described in Attachments 2 through 4 of this opinion); and the cumulative effects of actions anticipated in the action area.

NMFS has determined that EPA's approval of the spawning temperature standard is likely to adversely affect the following species, and result in their incidental take, because early spawning fish are not protected: southwest Washington/lower Columbia River coho salmon. Take associated with EPA's approval of the spawning temperature standard is not likely to be of a duration that would appreciably diminish the likelihood of survival and recovery of these species, nor is it likely to result in destruction or adverse modification of critical habitat. Development and application of the reasonable and prudent measure identified in the Incidental Take Statement (section X, below) has the potential to minimize adverse effects from approval of the spawning temperature standard.

d. Snake River Basin, Middle and Lower Columbia, Upper Willamette, Oregon Coast, and Klamath Mountains Province steelhead trout:

The NMFS has determined, based on the information, analysis, and assumptions described in this Opinion, that EPA's proposed approval of the State of Oregon's spawning temperature standard is not likely to jeopardize the continued existence of Snake River Basin, Middle and Lower Columbia, Upper Willamette, Oregon Coast, or Klamath Mountains Province steelhead trout, or result in the destruction or adverse modification of designated critical habitat. In arriving at this determination, NMFS considered the current status of the listed and proposed salmonid ESUs; environmental baseline conditions; the direct and indirect effects of approving the standards; whether waters meeting the standards would meet the biological requirements of the listed and proposed species at both the individual and population levels; commitments by EPA and the Oregon Department of Environmental Quality to implement certain conservation measures (described in Attachments 2 through 4 of this opinion); and the cumulative effects of actions anticipated in the action area.

NMFS has determined that EPA's approval of the spawning temperature standard is likely to adversely affect the following species, and result in their incidental take, because late spawning fish are not protected: Snake River Basin, Middle and Lower Columbia River, and Upper Willamette River steelhead. Take associated with EPA's approval of the spawning temperature standard is not likely to be of a duration that would appreciably diminish the likelihood of survival and recovery of these species, nor is it likely to result in destruction or adverse modification of critical habitat. Development and application of the reasonable and prudent measure identified in the Incidental Take Statement (section X, below) will minimize adverse effects from approval of the spawning temperature standard.

e. Columbia River Chum Salmon

The NMFS has determined, based on the information, analysis, and assumptions described in this Opinion, that EPA's proposed approval of the State of Oregon's spawning temperature standard is not likely to jeopardize the continued existence of Columbia River Chum Salmon, or result in the destruction or adverse modification of designated critical habitat. In arriving at this determination, NMFS considered the current status of the listed and ESU; environmental baseline conditions; the direct and indirect effects of approving the standards; whether waters meeting the standards would meet the biological requirements of the listed and proposed species at both the individual and population levels; commitments by EPA and the Oregon Department of Environmental Quality to implement certain conservation measures (described in Attachments 2 through 4 of this opinion); and the cumulative effects of actions anticipated in the action area.

f. Umpqua River sea-run cutthroat trout , and southwestern Washington/Columbia River coastal cutthroat trout:

The NMFS has determined, based on the information, analysis, and assumptions described in this Opinion, that EPA's proposed approval of

the State of Oregon's spawning temperature standard is not likely to jeopardize the continued existence of Umpqua River sea-run cutthroat trout or southwestern Washington/Columbia River coastal cutthroat trout, or result in the destruction or adverse modification of designated critical habitat. In arriving at this determination, NMFS considered the current status of the listed and proposed salmonid ESUs; environmental baseline
conditions; the direct and indirect effects of approving the standards; whether waters meeting the standards would meet the biological requirements of the listed and proposed species at both the individual and population levels; commitments by EPA and the Oregon Department of Environmental Quality to implement certain conservation measures (described in Attachments 2 through 4 of this opinion); and the cumulative effects of actions anticipated in the action area.

NMFS has determined that EPA's approval of the spawning temperature standard is likely to adversely affect the following species, and result in their incidental take, because late spawning fish are not protected: Umpqua River sea-run cutthroat trout, and southwestern Washington/Columbia River coastal cutthroat. Take associated with EPA's approval of the spawning temperature standard is not likely to be of a duration that would appreciably diminish the likelihood of survival and recovery of these species, nor is it likely to result in destruction or adverse modification of critical habitat. Development and application of the reasonable and prudent measure identified in the Incidental Take Statement (section X, below) will minimize adverse effects from approval of the spawning temperature standard.. Take associated with EPA's approval of the spawning temperature standard is not likely to be of a duration that would appreciably diminish the likelihood of survival and recovery of these species, nor is it likely to result in destruction or adverse modification of critical habitat. Development and application of the reasonable and prudent measure identified in the Incidental Take Statement (section X, below) will minimize adverse effects from approval of the spawning temperature standard.

3) Narrative criteria

The NMFS has determined, based on the information, analysis, and assumptions described in this Opinion, that EPA's proposed approval of the State of Oregon's narrative temperature criteria is not likely to jeopardize the continued existence of the following listed and proposed anadromous salmonid species, or result in the destruction or adverse modification of designated critical habitat: Sockeye Salmon (Snake River), Chinook Salmon (Snake River spring/summer and fall, Upper Willamette River, Upper Columbia River spring, Lower Columbia River, Southern Oregon/California Coastal), Coho Salmon (Oregon Coast, and Southern Oregon/Northern California), Columbia River Chum Salmon, Steelhead Trout (Snake River Basin, Upper, Middle and Lower Columbia River, and Upper Willamette River), and cutthroat trout (Umpqua River sea-run cutthroat trout, and southwestern Washington/Columbia River coastal). In arriving at this determination, NMFS

considered the current status of the listed and proposed salmonid ESUs; environmental baseline conditions; the direct and indirect effects of approving the criteria; whether waters meeting the standards would meet the biological requirements of the listed and proposed species at both the individual and population levels; commitments by EPA and the Oregon Department of Environmental Quality to implement certain conservation measures (described in Attachments 2 through 4 of this opinion); and the cumulative effects of actions anticipated in the action area.

C. pH Standards

The NMFS has determined, based on the information, analysis, and assumptions described in this Opinion, that EPA's proposed approval of the State of Oregon's pH standard is not likely to jeopardize the continued existence of the following listed and proposed anadromous salmonid species, or result in the destruction or adverse modification of designated critical habitat: Sockeye Salmon (Snake River), Chinook Salmon (Snake River spring/summer and fall, Upper Willamette River, Upper Columbia River spring, Lower Columbia River, Southern Oregon/California Coastal), Coho Salmon (Southwest Washington/Lower Columbia River, Oregon Coast, and Southern Oregon/Northern California), Columbia River Chum Salmon, Steelhead Trout (Snake River Basin, Upper, Middle and Lower Columbia, Upper Willamette, Oregon Coast, and Klamath Mountains Province), and cutthroat trout (Umpqua River sea-run cutthroat trout, and southwestern Washington/Columbia River coastal). In arriving at this determination, NMFS considered the current status of the listed and proposed salmonid ESUs; environmental baseline conditions; the direct and indirect effects of approving the standards; whether waters meeting the standard would meet the biological requirements of the listed and proposed species at both the individual and population levels; and the cumulative effects of actions anticipated in the action area.

VIII. Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Conservation recommendations are discretionary measures suggested to minimize or avoid adverse effects of a proposed action on listed species, to minimize or avoid adverse modification of critical habitat, to develop additional information, or to assist the Federal agencies in complying with their obligations under section 7(a)(1) of the ESA. The

NMFS believes the following conservation recommendations are consistent with these obligations and therefore should be implemented by the EPA:

1) Cooperate with NMFS in soliciting proposals for and funding three research projects that will address existing data gaps regarding water temperature and its effects on listed and proposed species:

   a. an effort to compile historic temperature data for salmon-bearing watersheds in representative ecoregions of Oregon;

   b. an effort to model what stream temperatures could be attained based on changes in vegetation, flow restoration, and restoration of hydrologic connections to groundwater and floodplains in representative ecoregions of Oregon;

   c. a field study of how temperature effects at a sublethal level affect anadromous fish distribution, reproduction and production.

2) Cooperate with ODEQ so that NMFS obtains the results of any fish kill investigations occurring within waters meeting ODEQ water quality standards for DO, temperature and pH.

IX. Reinitiation of Consultation

Consultation must be reinitiated if: the amount or extent of taking specified in the Incidental Take Statement is exceeded, or is expected to be exceeded; new information reveals effects of the action may affect listed species in a way not previously considered; the action is modified in a way that causes an effect on listed species that was not previously considered; the specified state and Federal conservation measures contained in Attachments 2, 3, and 4 of this Opinion are not being implemented in accordance with specified timelines; or a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16).

The NMFS, working with the EPA and ODEQ, will assess action agency consistency with the conservation measures contained in Attachments 2, 3 and 4 of this Opinion, at six month intervals. This assessment will be based on NMFS' consideration of EPA action agency

implementation reports or presentations, completion of analyses, guidance documents, and other work products, application of specified guidance documents, procedures, and other conservation measures, and progress in the temperature standard review effort described in Attachment 4 of this Opinion, all in accordance with the timelines included in Attachments 2, 3 and 4 of this Opinion.

The NMFS will reconsider its conclusion on the effects of EPA's action, and will review whether this Opinion is still valid, if any of the following occur:

1) Based on the assessments described above, the ODEQ and EPA measures that were pivotal to the conclusion of this Opinion[1] are not fully developed and applied according to the specified timelines included in Attachment 2, 3 and 4 of this Opinion. The NMFS will notify the EPA if such evidence is found, and the EPA will have 30 days to demonstrate sufficient corrective actions;

2) the Regional Temperature Criteria Development Project described in Attachment 4 of this Opinion is abandoned, or fails to develop regional temperature criteria, according to the specified timeline, that NMFS, working with the EPA, determines will meet the biological requirements of listed anadromous salmonids for survival and recovery; or
3) the ODEQ does not adopt the recommended temperature criteria as its temperature standard, according to the specified timeline, and EPA in turn does not promptly begin promulgation of the recommended temperature criteria in Oregon.

Any subsequent Clean Water Act approval by EPA of a modified temperature standard adopted by the State of Oregon, or promulgation of modified standards by EPA, would constitute a new federal action requiring section 7 consultation. A subsequent Opinion on a new approval or promulgation action would supersede the conclusion of this Opinion with respect to the adequacy of Oregon's water temperature standards.

[1] Conservation measures pivotal to the conclusion of this Opinion include both of the EPA measures, including the Regional Temperature Criteria Development Project described in Attachment 4 of this Opinion, and ODEQ measures 2, 3, 4, 8, and 11, found in Attachment 3 of this Opinion.

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XI. Incidental Take Statement

Sections 4(d) and 9 of the ESA prohibit any taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct) of listed species without a specific permit or exemption. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, and sheltering. Harass is defined as actions that create the likelihood of injuring listed species to such an extent as to significantly alter normal behavior patterns which would include, but are not limited to breeding, feeding, and sheltering. Incidental take is take of listed species that results from but is not the purpose of, the Federal agency or the applicant carrying out otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of, the agency action is not considered prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

An incidental take statement specifies the amount or extent of any incidental taking of endangered or threatened species. It also provides reasonable and prudent measures that are necessary to minimize impacts and sets forth terms and conditions with which the action agency must comply in order to implement the reasonable and prudent measures.

The measures described below are non-discretionary. They must be implemented by the action agency so that they become binding conditions necessary in order for the exemption in section 7(o)(2) to apply.

A. Amount or Extent of Incidental Take

For the purposes of this Opinion, incidental take is defined as take that results from adoption and approval of the Oregon water quality standards for dissolved oxygen, temperature and pH. Incidental take resulting from approval of these water quality standards is authorized only for EPA and ODEQ, and only in waterbodies meeting these Oregon water quality standards. Incidental take associated with other agencies or landowners, or within waterbodies not meeting these Oregon water quality standards, is beyond the scope of this consultation, and consequently is not covered under this incidental take statement.

The amount or extent of incidental take resulting from the proposed action is difficult to assess. Finding dead or impaired individuals is unlikely, and mortality related to the proposed action may be difficult to discern from mortality due to other factors. The initial amount or extent of

incidental take associated with EPA's action will be of limited duration. NMFS expects development and application of the EPA and ODEQ conservation measures described in Attachments 2, 3, and 4 of this Opinion will minimize take associated with EPA's action. The ODEQ conservation measures resulting in rulemaking will require EPA approval and ESA section 7 consultation with NMFS. Therefore, incidental take related to EPA's approval of the dissolved oxygen and temperature standards is authorized only until the EPA and ODEQ conservation measures for dissolved oxygen and temperature, respectively, are applied, at which time NMFS will reassess incidental take related to each standard and species.

B. Reasonable and Prudent Measures

The NMFS believes that the following reasonable and prudent measure(s) are necessary and appropriate to minimizing take of the listed and proposed species and/or minimize the adverse modification of designated or proposed critical habitat:

1) EPA shall carry out the conservation measures described in Attachments 2 and 4 of this Opinion.

C. Terms and Conditions

1) EPA, working with the ODEQ and USFWS, shall assist NMFS in assessing consistency with the conservation measures contained in Attachments 2, 3, and 4 of this Opinion, at six month intervals.

2) Within 90 days of the completion of the Regional Temperature Criteria Development Project (Attachment 4 of this Opinion), EPA shall transmit the Regional Temperature Criteria to the ODEQ, and will recommend that ODEQ revise its temperature standard according to those criteria.

The terms and conditions of an incidental take statement usually include reporting and monitoring requirements that assure adequate action agency oversight of incidental take. In this case, given the large geographic area and number of species addressed in this consultation, and the difficulty of detecting incidental take from water quality effects in waters meeting water quality standards, monitoring of incidental take would require a tremendous expenditure of resources. Also, incidental take is only authorized for a limited amount of time, by the end of which

results of any monitoring would likely not yet be available. Therefore, NMFS did not include monitoring of incidental take. However, NMFS does request in its conservation measures that EPA (1) cooperate with NMFS in a field study of how temperature effects at a sublethal level affect anadromous fish distribution, reproduction and production; and (2) cooperate with ODEQ so that NMFS obtains the results of any fish kill investigations occurring within waters meeting ODEQ water quality standards for dissolved oxygen, temperature and pH.

ATTACHMENT 1

June 22, 1998, letter from Michael T. Llewelyn, Administrator, Water Quality Division, ODEQ, to Philip Millam, Director, Office of Water, EPA.

ATTACHMENT 2

June 17, 1999 letter from Randall Smith, EPA, to Rick Applegate, NMFS.

ATTACHMENT 3

June 11, 1999 letter from Michael T. Lleweln, ODEQ, to Randy Smith, EPA, with attached conservation measures.

ATTACHMENT 4

EPA Proposal for Regional Temperature Criteria Development Project (June 25, 1999 draft).